`SDMS US EPA Region V

Imagery Insert Form

Document ID:

EPA Region 5 Records Ctr.

200958

Some images in this document may be illegible or unavailable in SDMS. Please see reason(s) indicated below:

[X] Illegible due to bad source documents. Image(s) in SDMS is equivalent to hard copy.

Specify Type of Document(s) / Comments:

American Chemical Service - Maps

[ ] Includes _____ COLOR or _____ RESOLUTION variations.
Unless otherwise noted, these pages are available in monochrome. The source document page(s) is more legible than the images. The original document is available for viewing at the Superfund Records Center.

Specify Type of Document(s) / Comments:

[ ] Confidential Business Information (CBI).
This document contains highly sensitive information. Due to confidentiality, materials with such information are not available in SDMS. You may contact the EPA Superfund Records Manager if you wish to view this document.

Specify Type of Document(s) / Comments:

[ ] Unscannable Material:
Oversized _____ or _____ Format.
Due to certain scanning equipment capability limitations, the document page(s) is not available in SDMS. The original document is available for viewing at the Superfund Records center.

Specify Type of Document(s) / Comments:

[ ] Document is available at the EPA Region 5 Records Center.

Specify Type of Document(s) / Comments:

?000023 K.10

American Chemical Service, Inc. NPL Site

Barrier Wall and Associated Groundwater Extraction System and Pilot Study Test Cell

50 Percent Design Submittal

June 1996

MONTGOMERY WATSON

BARRIER WALL AND ASSOCIATED GROUNDWATER EXTRACTION SYSTEM AND PILOT STUDY TEST CELL 50 PERCENT DESIGN SUBMITTAL

AMERICAN CHEMICAL SERVICE, INC. NPL SITE

GRIFFITH, INDIANA

JUNE 1996

PREPARED FOR:

ACS RD/RA EXECUTIVE COMMITTEE

PREPARED BY:

MONTGOMERY WATSON AMERICAS, INC.

TABLE OF CONTENTS

Table of Contents

Table of Contents

Table of Contents

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

1.1 PURPOSE

This 50 Percent Design Submittal for the subsurface barrier wall, the associated groundwater extraction system, and the pilot study test cell was prepared by Montgomery Watson Americas, Inc. (Montgomery Watson) on behalf of the Respondents to the Unilateral Administrative Order (UAO) issued by the United States Environmental Protection Agency (U.S. EPA), Region V, on September 30, 1994 for the American Chemical Service, Inc. (ACS) Site in Griffith, Indiana. The elements discussed in this document are being implemented to facilitate, or to be a part of, the overall remedy for the Site, but they do not comprise the entire remedy. Additional components of the remedy have and will be submitted in other documents.

The test cell is being installed to expedite the dewatering of the area where the SVE pilot treatability study will be conducted. The barrier wall and associated groundwater extraction system (BWES) are being installed to prevent the migration of contaminants from the waste areas, to initiate the dewatering of the waste areas, and to minimize the recharge of groundwater into the waste areas as they are dewatered. Dewatering of the waste areas is necessary for the remedy as defined in the ROD and this effort could take a substantial amount of time to complete. By expediting the BWES, the dewatering process will be underway sooner and the opportunity exists to obtain additional data regarding the quantity and quality of the water so that timely modifications can be made to the extraction and treatment system, if needed. In addition, the perimeter groundwater extraction trench is being installed this summer and, once operational, it will increase the potential for contamination to migrate from the waste areas toward the trench. Therefore, it is essential to have the barrier wall in place before the trench is operational.

The purpose of this design submittal is to document the design concepts and decisions and to provide a mechanism for obtaining concurrence from U.S. EPA and the Indiana Department of Environmental Management (IDEM). This document was prepared in accordance with the scope of work stated in the Barrier Wall Alignment Report which was submitted to U.S. EPA and IDEM in March 1996.

1.2 PROJECT BACKGROUND

1.2.1. Site Description

The ACS Site is located at 420 South Colfax Avenue in the City of Griffith, Indiana, which is in the northwestern corner of the state. The Site is bordered on the east and northeast by Colfax Avenue. The Chesapeake and Ohio railway bisects the Site in a northwest-southeast direction, between the fenced On-Site Area (north) and the Off-Site Area (south). On the west and northwest, south of the Chesapeake and Ohio railway, the Site is bordered by the abandoned Erie and Lackawanna railway, and the Griffith Municipal Landfill. North of the Chesapeake and Ohio railway, the Site is bordered on the west by wetland areas. The northern boundary of the Site is formed by the Grand Trunk railway.

There are five land disposal areas at the ACS Site: the On-Site Containment Area (ONCA), the Still Bottoms Pond (SBP) Area, the Treatment Lagoons, the Off-Site Containment Area (OFCA), and the Kapica/Pazmey Area[1]. Although an unused portion of the Griffith Municipal Landfill is located within U.S. EPA's boundaries of the Site, it is not included as part of the remedy. The landfill is an active solid waste disposal facility that has operated since the 1950s and it is currently going through closure.

1.2.2. Operational History

The ACS Site comprises approximately 30 acres of land which contains an active chemical processing facility and several former land disposal areas. The chemical processing facility began operation in May 1955 as a solvent recovery facility. Solvent recovery remained the primary operation performed on-site through the late 1960s, when the manufacture of small quantities of specialty chemicals began. These manufacturing operations included treating rope with fungicide, bromination and treating ski cable.

In 1961, ACS sold a two-acre parcel to John Kapica, and in 1962 Kapica began the operation of his drum reclaiming business at the location. Operations at Kapica Drum,

[1] The terms On-Site and Off-Site are used to denote particular portions of the ACS Site: both areas are within the CERCLA Site. The Off-Site Containment area is designated as off-site only because it is adjacent to, rather than within the boundaries of the property where ACS currently conducts its chemical formulation operations. However, ACS owns the property and as noted, for CERCLA purposes, both of these areas are considered on-site.

Inc., consisted of drum reconditioning. Kapica Drum was sold to Pazmey Corporation in February 1980. Kapica/Pazmey operated from 1980 to 1987. The Pazmey Corporation property was sold to Darija Djurovic in March 1987.

ACS' solvent operations involved spent solvent mixtures containing alcohols, ketones, esters, chlorinated solvents, aromatics, aliphatics, and glycols. In the early years of operation, spent solvents were stored in 55-gallon drums at various locations at the Site. Solvent recovery was performed in batch evaporation units, which were charged by pumping material directly from 55-gallon drums into the evaporation vessels. Still bottoms from the evaporation vessels were disposed in the Still Bottom Pond, prior to the installation of incinerators at the facility. ACS installed its first incinerator in 1966 and installed a second incinerator in 1969. The incinerators were used to burn still bottoms and non-reclaimable materials generated at the Site, and wastes from off-site. The incinerator units were dismantled in 1977.

From 1970 to 1975, the spent solvents reclaimed at the Site were similar to those which were handled in the 1960s. However, an increasing percentage of shipments were received at the Site in bulk tanker trucks. In addition, the batch manufacturing processes were expanded during this period. A lard oil process which utilized tallow and animal rendering was used to manufacture a lubricant product. This process, along with a soldering flux operation, was discontinued prior to 1990. In 1971, the additive manufacturing area was built. Various detergents lubricants, and chemical additives were manufactured, in addition to soldering flux, various amines, methanol, formaldehyde, sodium hydroxide, and maleic anhydride. An epoxidation plant was constructed in 1974 and a bromination operation using hexane was added in 1975. At various times up until 1990, the epoxidation plant used toluene or benzene as a reaction carrier.

Some time between 1975 and 1990, the solvent distillation units were replaced with new units though the types of solvent wastes reclaimed remained essentially the same. Spent solvent and reclaimed solvent recovery tank farms were constructed during this time period and the majority of the spent solvent waste streams were shipped in bulk tanker trucks, although drummed wastes were still processed. A hazardous waste drum unloading dock and storage area was built in the early 1970s, with spill containment curbing and a sump area added at a later date. In September 1990, ACS ceased accepting hazardous waste shipments and filed for closure. On March 31, 1993 ACS completed closure and terminated its interim RCRA status. ACS currently operates as a chemical production facility at the Site. The operations include chemical reaction processes, custom blending, and product distribution. The facility encompasses 8.5 acres with process buildings, tank farms, loading and unloading areas, a laboratory and offices and support utility buildings. The company operates 24 hours per day, five to six days per week. The operating production facility is secured by a continuous fenceline with a single controlled access gate.

1.2.3. Land Disposal History

When ACS began operations in 1955, the still bottoms from the solvent recovery operations were disposed of in the Still Bottoms Pond/Treatment Lagoon area. In 1972, the pond and lagoons were drained, and drums, partially filled with sludge materials, were landfilled there.

The OFCA was utilized for the landfilling of wastes including excavated materials from the Still Bottoms/Treatment Lagoon from 1958 to 1975. The waste types disposed of in the OFCA over the course of ACS' operations also included general refuse, drums, still bottoms and incinerator ash. According to the ACS, Inc. owner/operator, drums placed in the OFCA were crushed or punctured as part of the disposal process.

During the mid-1960s, it is estimated that approximately 400 drums of sludge and semi-solids were landfilled in the ONCA. Observations made during test pit excavations in 1993 did not detect any intact drums. Residual wastes and rinse waters from the Kapica/Pazmey drum reconditioning operation were disposed of on the ground in the Kapica/Pazmey Area.

1.2.4. Administrative History

In February 1980, the U.S. EPA performed a Preliminary Assessment of the ACS Site, collecting samples in the Off-Site Containment Area and at the Griffith Municipal Landfill in May 1980. The U.S. EPA performed a site inspection on September 9, 1980, and in July 1982, U.S. EPA contractors installed four monitoring wells near the Off-Site Containment Area and the Griffith Landfill. Based upon information developed during these investigative efforts, a hazard ranking system score of 34.98 was assigned to the ACS Site by U.S. EPA in June 1983.

In 1986, a group of approximately 125 Potentially Responsible Parties (PRPs) formed a Steering Committee to conduct the Remedial Investigation/Feasibility Study (RI/FS) pursuant to an agreement with the U.S. EPA. The PRPs signed a Consent Order to perform the RI/FS in June 1988. Following U.S. EPA approval of the RI/FS Work Plan, the field investigation for Phase I of the RI began in July 1989. Phase II RI field work began in March 1990, and in December 1990, the Phase III RI field work was initiated. The RI report was completed in June 1991. Warzyn (now Montgomery Watson Americas, Inc.) completed the FS report in June 1992.

In June 1992, the U.S. EPA published notice of its Proposed Plan for Remedial Action for the ACS Site. The remedy presented in that Proposed Plan was described by U.S. EPA as a modification of Remedial FS Alternative 6B. The U.S. EPA issued a Record of Decision (ROD) in September 1992. The Unilateral Administrative Order (UAO) was issued on September 30, 1994. The Respondents provided notice to the U.S. EPA of their intent to comply with the UAO, and have developed the planning documents and performed other tasks required by the UAO to date.

1.3 SCOPE OF THE BARRIER WALL AND GROUNDWATER EXTRACTION SYSTEM DESIGN

The remedy presented in the ROD for the ACS Site includes the following components:

- Groundwater pumping and treatment to dewater the Site and to contain the contaminant plume with subsequent discharge of the treated groundwater to surface water and wetlands;

- Excavation of approximately 400 "intact" buried drums in the ONCA for off-site incineration;

- Excavation of buried waste materials and treatment by low temperature thermal treatment (LTTT);

- On-site treatment or off-site disposal of treatment condensate;

- Vapor emission control during excavation and possible immobilization of inorganic contaminants after LTTT;

- Off-site disposal of miscellaneous debris;

- In-situ vapor extraction pilot study of buried waste in the On-site Area;

- In-situ vapor extraction of contaminated soils;

- Continued evaluation and monitoring of wetlands and, if necessary, remediation;

- Long-term groundwater monitoring;

- Fencing the Site and implementation of deed and access restrictions and deed notices; and

- Private well sampling with possible well closures or groundwater use advisories.

The barrier wall and associated groundwater extraction system proposed by the alleged PRPs will serve to accomplish or facilitate many of the above components of the remedy. The work is being implemented on an expedited schedule for the following reasons:

- The perimeter groundwater extraction trench is being installed this summer and, once operational, it will increase the potential for contamination to migrate from the waste areas toward the trench (i.e., towards the Site boundary). Consequently, it is essential to have the barrier wall in place before the trench is operational.

- Dewatering of the waste areas is necessary for the remedy as defined in the ROD and this effort could take a substantial amount of time to complete. In addition, there is significant uncertainty about the quantity and quality of water that needs to be extracted (i.e., dewatered). By expediting the barrier wall and extraction system, the dewatering process will be underway sooner and the opportunity exists to obtain additional data regarding the water so that timely modifications can be made to the extraction and treatment system, if needed, to accommodate the dewatering water.

The scope of the BWES design includes the following:

- A subsurface barrier wall
- A groundwater extraction system and conveyance piping within the barrier wall to deliver the groundwater to the perimeter groundwater containment system (PGCS) treatment system
- Two sheet pile test cells for conducting the treatability studies.

To implement the barrier wall and the extraction system on an expedited basis, this work is being conducted utilizing the *design/build delivery system* as agreed with the U.S. EPA and IDEM. Under this delivery system, the level of detail in the design documents is less than that which would be required using the design-bid-build delivery system. Consequently, certain components of this design deliverable may not be as detailed as those typically provided with design-bid-build projects. The specific materials and equipment shown on the drawings should therefore be considered preliminary since they may change as the design evolves throughout the construction process. The system will, however, be designed and constructed to meet the requirements of Section E on page 4 of the Statement of Work (SOW) issued by U.S. EPA. With the above in mind, review of this submittal should focus on the design basis, in particular the design criteria, and on the performance standards to be met instead of on specific details.

As agreed upon and reflected in the June 12, 1996 meeting, U.S. EPA and IDEM will not be commenting on this document but will focus on the Performance Standard Verification Plan. Further, based on U.S. EPA's letter dated June 6, 1996, the alignment and construction of the barrier wall has already been approved.

2.0 BARRIER WALL DESIGN BASIS

2.1 PURPOSE

The purpose of the barrier wall is to prevent the post-installation migration of contaminants from the waste areas (specifically the Still Bottoms Pond and Off-Site Containment Area) to the Site boundary, and to minimize the recharge of groundwater into these waste areas as they are being dewatered. A continuous barrier wall, approximately 4,000 ft long and averaging 25 ft deep, will be constructed around the waste areas (refer to Figure 2 in Appendix A).

2.2 TECHNOLOGIES CONSIDERED

Several barrier wall technologies were considered, including soil-bentonite, vibrating beam, deep soil mixing, sheet pile, and geomembrane panel. Contractors with experience in one or more of these barrier wall technologies were pre-qualified, and then they were provided a Request for Bid (RFB) for design-build. Each barrier wall technology was represented. Five bids were received. Three contractors proposed a conventional soil-bentonite slurry wall excavated with a backhoe, although they reserved the possibility of requiring additives or bentonite replacement pending results of specific compatibility testing. One contractor proposed a vibrating beam slurry wall, and the other proposed a geomembrane panel wall. After careful consideration of technical, construction, schedule, contractual, warranty, and cost issues, the contractor proposing the geomembrane panel wall technology was selected. This contractor is Horizontal Technologies, Inc. (HTI) of Cape Coral, Florida.

2.3 GEOMEMBRANE PANEL BARRIER WALL

2.3.1 Overview

HTI will design and install a geomembrane panel barrier wall, which they refer to as the Polywall Barrier System (Polywall). The Polywall will consist of a 60-mil high density polyethylene (HDPE) flexible membrane liner that is unrolled in a nominal 16-in. wide trench filled with bentonite slurry. HTI custom fabricated a trencher that excavates the trench, unfurls the roll of HDPE from a box in the trench, and backfills the trench with the excavation spoils in one pass. The trench will be keyed into the underlying clay unit.

This construction methodology results in a dual barrier wall, consisting of the Polywall and an 8-in.(approximately) thick soil-bentonite wall on either side.

The 60-mil HDPE rolls are approximately 120 ft long. An interlocking joint, much like that of a sheet pile joint, will join successive rolls. A male and female joint are fusion welded to the ends of the HDPE rolls in a controlled environment before job site delivery. The welded joints are subjected to quality control/quality assurance testing. A cord of hydrophilic rubber is placed in the female joint, to provide an extra assurance of a tight seal, as the next Polywall roll is suspended vertically with a crane and lowered into the male joint on the other roll. This process is continued until the loop is completed.

2.3.2 Design

The general alignment of the barrier wall and cross-sections are included in Appendix A. The general alignment is based on the results of previous borings and analytical results to determine the waste limits; the final alignment within the identified narrow zone will be determined during design. Performance specifications used to solicit contractor bids are also included in Appendix A.

HTI will drill additional borings within the barrier wall alignment to verify the depth to the clay unit for key-in, and to collect on-site soils to perform backfill mix design testing (i.e., to determine the appropriate amount of bentonite in slurry form to mix with the on-site soils during backfilling of the Polywall to achieve the desired hydraulic conductivity). HTI will also collect contaminated groundwater from an existing monitoring well in the vicinity of the barrier wall alignment to check whether the contaminated groundwater will affect the laboratory hydraulic conductivity of the hydrophilic rubber seal and the soil-bentonite backfill mixture. The baseline hydraulic conductivity will first be determined using distilled water.

HTI will prepare a design report, drawings, technical specifications, and construction quality control (CQC) plan. An operation and maintenance (O&M) plan will not be prepared since there will be no O&M associated with the completed barrier wall. Performance monitoring, described elsewhere in this submittal, will check the barrier wall's performance. The design report will present a detailed design of the barrier wall installation, site geological conditions, barrier wall layout and key-in, anticipated impacts on the existing ACS operations, construction schedule, and results of compatibility testing. Narrative will describe how the barrier wall will intersect existing surface and subsurface features, such as the railroad tracks and buried utilities, during (temporary) and after (permanent) construction. The schedule will identify the anticipated dates and duration for construction in different areas of the Site, including the ACS operating facility. A short section of the railroad tracks within the alignment (i.e., two crossings) will be temporarily removed, but returned to normal service shortly after barrier wall installation is completed in these areas. Buried utility laterals serving the ACS facility will also be temporarily taken out of service during barrier wall construction. Flow through the public sanitary sewer main, located along the north side of the railroad tracks, will not be disrupted.

Four drawings are anticipated to be included in the design report. One drawing will be a plan view showing the existing site features in relation to the barrier wall alignment. The top elevations of the clay unit will also be shown for reference during barrier wall trenching. Two profile drawings will show the ground and top of clay elevations along the entire alignment. One drawing will show details related to overlaps, the bottom key-in, surface completion, utility penetrations, and other details.

The list of preliminary specifications includes:

- Site preparation
- Erosion control
- Select fill
- Utility repair and replacement
- Surveys and field controls
- High density polyethylene
- Bentonite mixtures
- HDPE installation
- Waste handling
- Decontamination
- Site clean up
- Warranty maintenance

The final report, drawings, specifications, and construction CQC plan will be signed and sealed by a professional engineer registered in Indiana.

2.3.3 Construction Documentation

HTI will document installation of the Polywall in accordance with the construction CQC plan. A construction documentation report will be prepared describing all facets of installation. The design drawings will be updated to show record (as-built) conditions. Appendices will include daily field reports and CQC forms, the results of field and laboratory tests, horizontal and vertical survey information, and representative photographs. The final report will be signed and sealed by a professional engineer registered in Indiana.

3.0 EXTRACTION SYSTEM DESIGN BASIS

3.1 INTRODUCTION

The purpose of this section is to present the basis for the design of the groundwater extraction system associated with the barrier wall at the ACS Site. The information contained in this section includes the design assumptions, process design and performance criteria, and the design logic required to support the remedial design.

3.2 PURPOSE OF THE EXTRACTION SYSTEM

The purpose of the groundwater extraction system is to 1) lower the water table within the barrier wall such that an inward gradient exists, and 2) to initiate the dewatering of the area within the barrier wall.

3.3 EXTRACTION TRENCH DESIGN

3.3.1. Extraction Trench Location

Approximately nine to ten groundwater extraction trenches will be installed as part of the BWES. Trenches were selected over wells because they will be more effective in dewatering the shallow aquifer at the Site and because they are less susceptible to fouling. Drawings C-2 and C-3 (Appendix B) present the proposed locations for the extraction trenches. The proposed locations are subject to changes depending on the final alignment of the barrier wall.

3.3.2. Extraction Trench Length and Depth

Each extraction trench will be approximately 100 feet long and will be excavated down to the underlying clay layer. Available boring logs from the barrier wall alignment investigation work suggest that the elevation of the clay layer is constantly between 613 and 622 feet above mean sea level (amsl). The depth to the clay layer varies from 13 to 31 feet below ground surface (bgs) throughout the Site. The average depth of the barrier wall is estimated to be 25 feet.

A collection pipe will be placed near the bottom of each trench. Each pipe will be connected to a sump located at one end of the trench. The collection pipe will follow the trench bottom contour.

3.3.3. Groundwater Extraction Rates

The extraction trenches were modeled using Visual Modflow to optimize trench configuration and extraction rates. Based on these modeling efforts, an extraction rate of 2 to 3 gallons per minute (gpm) per trench will be sufficient to achieve the stated purpose of the extraction system. The calculations are based on the assumption that surface infiltration can be maintained below 10 inches per year. A summary of the groundwater modeling used to design this portion of the remedy is presented in Appendix C.

3.3.4. Trenching and Backfill

Each trench will be constructed in such a way as to minimize the impacts to the Site and to avoid problems typically associated with excavating in areas with a high water table. The trenches will be backfilled with gravel or sand to provide a flow path to the extraction drain pipe. The drain pipe will be 6-inch diameter perforated chemical resistant high density polyethylene (HDPE) piping and it will be covered with a filter fabric sock. The drain pipes will be placed on top of the clay layer.

3.3.5. Extraction Trench Pump

Each sump will be equipped with a pneumatic pump with an adjustable internal float to control the desired drawdown. Each pump will have a check valve to prevent any back flow into the pump (Drawing M-1 to be completed). The design criteria for the extraction pumps will be presented in Drawing M-2 (to be completed). Pneumatic pumps were selected for the BWES for the following reasons:

- they perform better in low flow, slow recovery applications
- they can be operated in a cyclic mode (which is expected given low recharge rate) without damaging the pump
- they do not require any utility connections except for compressed air

- they provide a safe operating environment in areas where free product may be encountered.

3.3.6. Sumps and Vaults

The sump in each trench will be constructed of 8- to 12-inch diameter perforated HDPE pipe. The sump casing will extend essentially to the ground surface. Each sump will be finished with a threaded PVC cap with holes drilled for the connection hoses (i.e., compressed air, discharge water, and vent lines).

A concrete vault will be placed around each sump head to house the casing, compressed air filter/regulator, and the hose connections. The vault will be a precast-concrete type, with side openings to allow entrance and exit of the conveyance pipe and air supply line. Each vault will be complete with a cast iron cover rated for H-20 loading, ladder, warning sign, and other appurtenances, as shown on the Drawings.

Sumps and vaults will either be constructed flush to the ground or located out of traffic areas. The final location of sumps and vaults will be dependent on the final alignment of the barrier wall.

3.4 PIEZOMETER DESIGN

A performance monitoring system will be installed at each extraction trench location. Eight of the trenches will be aligned along the barrier wall. One or two will be located within the center of the area enclosed by the barrier wall. For the trenches located along the wall, the system monitoring will consist of two piezometers at each trench location: one inside the barrier wall and one outside. Each piezometer will be located equidistant from the trench as shown on Drawings C-2 and C-3. The piezometers will either be constructed flush to the ground or located out of traffic areas. The final location of piezometers will be dependent on the final alignment of the barrier wall.

The piezometers will be constructed of 2-inch diameter Schedule 40 PVC riser pipe with a 304 stainless steel or Schedule 40 PVC, 0.010-inch slot size screen. The total depth of the piezometers will vary depending on the depth to the groundwater. The total screen length will be 10 feet. A 1/8-inch weep hole will be drilled into the PVC casing to allow water-level fluctuations with changes in the barometric pressure. The PVC casing will be completed with a water tight, threaded PVC cap to allow for water level measurements. A protective steel casing will be placed on top of the PVC casing. The protective steel casing will extend down to the bentonite-chip material fill.

3.5 CONVEYANCE PIPE DESIGN

3.5.1. Pipe Material

Extracted groundwater will be conveyed to the PGCS treatment facility through a single-wall, HDPE pipe. HDPE was selected since it is less susceptible to leakage (i.e., fusion-welded joints) compared to polyvinyl chloride (PVC), is also more resistant to solvents compared to PVC, and is more flexible compared to PVC. HDPE pipe can also be pressure tested for leaks during installation. For these reasons, HDPE is the preferred pipe material for the extraction system.

3.5.2. Pipe Size

Based on the flow range of 13 to 25 gpm, the conveyance pipe will be 2 inches in diameter. A 2-inch diameter pipe will be able to handle the entire range of flows without creating excessive pressure drop or allowing solids deposition in the pipe. A 2-inch diameter pipe will also provide excess capacity for potential future expansion of the extraction system. The conveyance pipe will be buried 3 to four 4 below the ground surface to prevent freezing during the winter months.

3.5.3. Conveyance Pipe Tie-In

The conveyance pipe will tie-in to the PGCS treatment facility inside the treatment system building.

3.6 PNEUMATIC SYSTEM DESIGN ASPECTS

3.6.1. Compressed Air Requirements

The duplex air compressor to be installed as part of the PGCS treatment facility will also be used to supply compressed air to the groundwater extraction pumps associated with the BWES. Preliminary calculations suggest that the total air requirements for the extraction system are 20 standard cubic feet per minute (scfm) at 40 pounds per square inch gauge (psig), which is well within the excess capacity of the air compressor at the PGCS treatment facility.

3.6.2. Air Distribution

The main air supply line from the air compressor will be 1-inch diameter Schedule 40 PVC. It will be buried 3 to 4 feet below ground surface to prevent freezing during the winter months. An air dryer will be installed on the main line to remove excess moisture from the air supply. A three-way vent valve will also be installed to vent the air supply line during periods when the pumps are not in operation.

A 3/4-inch diameter Schedule 40 PVC air distribution pipe will be provided to individual well heads. An air pressure regulator will be installed at each well head to regulate air supply to individual extraction pumps.

3.6.3. Instrumentation and Control

The extraction trench pumps will operate pneumatically based on an internal float switch. No external controls will be provided for the pumps. A local flow meter, installed at each sump will monitor the flow from each extraction trench. A flow meter/totalizer will be installed on the combined discharge line just inside the treatment facility to record cumulative flow from the extraction system.

A normally-open, soler ıid valve will be installed on the main air supply line to the extraction system. The solenoid valve will close if any of the following conditions are activated at the PGCS treatment facility, thus cutting off the air supply to the extraction system, and preventing any further groundwater introduction to the treatment facility:

- High level in the pretreatment equalization tank
- High level in the main equalization tank
- Treatment system shutdown due to other alarm conditions.

4.0 TEST CELL DESIGN BASIS

4.1 PURPOSE

The purpose of the on-site test cell is to provide a temporary hydraulic barrier to expedite dewatering of the area where the SVE pilot treatability study will be conducted. The on-site test cell will be approximately 30 feet by 30 feet square in plan dimension. Steel sheet piling will be driven through the waste and soils into the underlying clay stratum for an effective key. The cell will be dewatered before conducting the SVE treatability study. No excavation inside the on-site cell is planned.

Since the sheet pile Request for Bid (RFB) was issued, a decision has been made to exclude installation of the off-site test cell. Therefore, the off-site test cell shown in the RFB (Appendix D) will not be included in the treatability studies. The modified drawings will be submitted with the 100 Percent Design Submittal.

4.2 TECHNOLOGIES CONSIDERED

Several barrier wall technologies were considered for the temporary test cell, as well as for the long-term barrier wall to be constructed around the impacted areas of the ACS facility. These technologies included soil-bentonite, vibrating beam, deep soil mixing, sheet pile, and geomembrane panel. Steel sheet pile was selected because of its relatively low cost, ease of installation, minimum disruption to the ACS facility, and the small volume of waste generated during its installation.

Contractors with experience in driving steel sheet piling were pre-qualified, and then they were provided a Request for Bid (RFB) to select, supply, and install the sheeting for the test cell. The RFB also specified a one year performance warranty. These bids were received, and bid evaluation is in progress at this time and includes consideration of technical, construction, schedule, contractual, warranty, and cost issues.

4.3 CONSTRUCTION PLANS

A portion of the sheet pile Request for Bid (RFB) is included in Appendix D and includes the sheet pile description, method of installation, method of sealing, pile driving/grouting equipment, definition of refusal, shop drawings, and sheet piling layouts.

Prior to mobilization by the selected subcontractor, Montgomery Watson Constructors Inc. (MWCI) will stake the test cell location and alignment. At the test cell location, MWCI will excavate a 5-ft deep trench approximately 3-ft wide along the alignment to remove possible obstructions that were encountered during the barrier wall alignment investigation. The trench will be backfilled with imported earth fill. This will greatly minimize the potential for obstructions during pile driving. Wastewater handling and soil disposal from excavation is being evaluated and will be addressed with the 100 Percent Design Submittal.

A template will be used by the selected subcontractor to align the piles in the proper configuration before driving. The piling will be driven with a vibratory hammer to key into the clay stratum based on existing boring information that was included in the RFB.

Prior to implementing the field activities, a plan will be prepared and submitted concerning wastewater handling and soil disposal from trenching work. The waste management plan would be included with the 100 Percent Design Submittal.

Test borings for the sheet pile test cells are reported in the Barrier Wall Technical Memorandum.

5.0 PERMIT/APPROVAL REQUIREMENTS

The remedial activities are being conducted pursuant to a Unilateral Administrative Order (UAO) which defines the framework under which the remedial design and remedial action is to proceed. Paragraph 28 of the UAO states that the actions required by the UAO are consistent with the National Contingency Plan, as amended, and CERCLA. Paragraph 52 goes further to state that permits are not required for any on-site activities. Given these facts, no permits are needed for construction of the barrier wall and the extraction system or operation of the extraction system at the ACS Site. Thus, design concepts and details have considered, as appropriate, compliance with the intent of applicable laws or regulations, even though permits will not be required. Key regulatory programs which have been evaluated are discussed in the following paragraphs.

5.1 WELL INSTALLATION REQUIREMENTS

Pursuant to CERCLA and UAO authorization, no permits are required for the BWES installation at the ACS Site. Design and construction details regarding the piezometers and the extraction trench will be prepared in advance of construction activities and submitted to the U.S. EPA for review.

5.2 CONSTRUCTION/BUILDING PERMIT

Pursuant to CERCLA and UAO authorization, no permits are required for installation of barrier wall at the ACS Site. However, the barrier wall design will meet the applicable state and local guidelines.

5.3 EFFLUENT DISCHARGE QUALITY CRITERIA

Groundwater from the BWES extraction trenches will be pumped directly to the PGCS treatment facility. Effluent discharge quality criteria for the PGCS treatment facility are discussed in the "PGCS 50 Percent Design Submittal dated March 1996".

5.4 UTILITY CONNECTIONS

Temporary utility connections required for the BWES construction include water and electric power supply. No permit requirements are anticipated for temporary utility connections. The source for each utility connection is described below.

5.4.1. Water

Potable and fire water for the BWES will be brought from the PGCS treatment system building if needed for construction. No permanent water connection is required for operation of the BWES.

5.4.2. Electric Power Supply

The new power service to be installed for the PGCS treatment facility will be used for the BWES. Alternately, an existing power line in the proximity of the BWES construction location may be tapped with a temporary connection. No permits will be required for these temporary services.

No permanent power connection is required in conjunction with the BWES operation.

5.5 TEMPORARY DISCHARGE OF CONSTRUCTION DEWATERING WATER

Temporary dewatering will occur during construction of the barrier wall and possibly during construction of the extraction trenches and conveyance lines. Dewatering water generated during the construction activities will be collected and the solids will be allowed to settle out. The settled water will then be treated by filtration and granular activated carbon adsorption. The temporary treatment system will be located close to the construction area to prevent long pipe runs. Treated water from the carbon units will be discharged to nearby drainage pathways. Spent cartridge filters and settled solids will be collected and periodically transported off site for disposal. Montgomery Watson is currently working out the specifics of this approach to handling the dewatering water with the U.S. EPA and IDEM.

6.0 CONSTRUCTION COST ESTIMATES AND SCHEDULE FOR PROJECT COMPLETION

6.1 CONSTRUCTION COST ESTIMATES

The total estimated construction costs for the barrier wall and associated groundwater extraction system are provided in Table 6-1. The costs presented in the table are the installed costs for the facilities including equipment purchase costs, installation, and construction management costs. Table 6-1 also provides an estimate of the annual operations and maintenance costs based on 24-hour per day, 365-day per year operation of the groundwater extraction system. Note that the annual operation and maintenance costs for treatment of extracted groundwater were included in the cost estimates for the PGCS treatment facility.

6.2 SCHEDULE FOR PROJECT COMPLETION

The schedule for completion of the pre-construction and construction activities is being integrated into the overall project schedule. A detailed, specific schedule for the construction will be developed once an approximate start date is agreed upon. Construction of the BWES facilities is anticipated to take approximately three months from notice-to-proceed. Construction of the BWES is expected to be completed by December 6, 1996. Startup and testing of the facilities is expected to take an additional two weeks following completion of construction.

TABLE 6-1

ESTIMATED COSTS
BARRIER WALL AND ASSOCIATED GROUNDWATER EXTRACTION SYSTEM AND PILOT TEST CELLS CONSTRUCTION

Item Number	Description		Cost
1	Barrier Wall [2]		$1,200,000
2	Groundwater Extraction System [3]		$196,306
3	Conveyance Trench and Piping [4]		$70,000
4	Performance Monitoring System [5]		$51,270
5	Pilot Test Cells [6]		$330,000
		Subtotal	$1,847,576
6	Contractor's Insurance, Overhead, and Profit		$231,000
7	Engineering Oversight, Reports, As Builts		$92,379
		Subtotal	$323,379
	Total Project Capital Cost		**$2,170,955**

Item Number	Description	Annual Cost
1	Extraction System Equipment Maintenance	$4,000
2	Piezometer Rehabilitation [7]	$21,885
3	Labor for Extraction System Operation	$8,800
4	Labor for Water-Level Measurements [8]	$17,600
5	Reporting and Documentation [9]	$10,000
	Total Annual O&M Costs	**$62,285**

(1) Capital costs are inclusive of material, labor, installation, and subcontractor costs.

(2) Based on the proposed costs by the selected subcontractor for the present alignment.

(3) Costs for nine extraction trenches, each 100 feet long and to a maximum depth of 35 feet.

(4) Costs for a 1 foot wide trench with a 2-inch HDPE and 1-inch PVC lines, each 3,400 feet long. Trench to be backfilled with native material with minimal compaction.

(5) Fifteen new, 2-inch PVC piezometers are assumed to an average depth of 20 feet; stainless steel or PVC Sch. 40 screen with an above-ground termination.

(6) Based on the proposed costs by the selected subcontractor for the proposed dimensions. Test cell dewatering system and water treatment are not included.

(7) Assumed rehabilitation every two years for each piezometer.

(8) Labor costs based on the proposed sampling frequency in the PSVP (Section 9.0).

(9) Costs for additional reporting beyond the PGCS facility documentation.

7.0 AMENDMENT II TO SITE SAFETY PLAN FOR BWES CONSTRUCTION ACTIVITIES

7.1 INTRODUCTION

This Site Safety Plan (SSP) Amendment has been prepared to supplement the Pre-Design Site Investigation, American Chemical Service, Inc. (ACS) SSP (referred to hereafter as the original SSP) developed in August 1995 for field activities at the ACS Site in Griffith, Indiana. This amendment is designed to provide site-specific information for the protection of field members during the Barrier Walls/Extraction System/Performance Monitoring System (BWPS) construction and installation. Field team members will follow the original SSP, except where noted in this amendment.

The field team members will be trained to follow the specific ACS Health and Safety requirements. These requirements will be followed during construction activities within an operating chemical facility at the Site.

7.2 BACKGROUND

The BWPS project includes the following:

- Construction of a subsurface barrier wall to contain the waste areas and limit groundwater excursion from these areas.
- Installation of monitoring wells and piezometers to assess the adequacy of the barrier walls.
- Construction of a groundwater extraction system.
- Sheet pile construction of test cell structures.

Construction activities are anticipated to occur throughout the entire Site.

7.3 CONSTRUCTION ACTIVITIES HAZARD ANALYSIS

Montgomery Watson will have at least one person at ACS during construction activities to provide project management and oversee site activities. Montgomery Watson will also provide personnel to conduct health and safety tailgate meetings and conduct health and safety audits. Specialty subcontractors will perform site preparation and construction tasks, which include:

- Monitoring wells and piezometer installation
- Soil excavation and trenching
- Backfill placement and soil compaction
- Excavation/remediation of PCB-containing soils and waste materials
- Electric service installation and maintenance
- Piping and controls installation for groundwater extraction system
- Sheet pile driving operations for test cell construction
- Soil amendment and mixing for barrier wall construction and placement
- Subsurface barrier wall construction.

Standard operating procedures (SOPs) for safe operation of equipment and acceptable execution of construction tasks will be provided on-site by the subcontractors. Additional SOPs are provided in Attachment A of this document. Included in this section are some general practices that will be enforced on-site during BWPS construction activities.

Chemical hazards from waste materials found at the ACS Site are addressed in Section 2 of the original SSP. Hazard evaluation techniques and the air monitoring strategy, as discussed in Section 5 of the original SSP, are prescribed to adequately evaluate the health implications of possible contaminants found at the ACS Site. Conformance with Section 5 of the original SSP is key to adequate assessment of health risks from airborne contaminants. The requirements for calibrations and frequency of direct monitoring are significantly related to the adequacy of the air monitoring strategy suggested in this document, as well as the requirements for monitoring for hydrogen cyanide gas and vinyl chloride.

Waste characterization data from the Draft Barrier Wall Alignment Investigation Technical Memorandum (dated March 14, 1996) were available for the preparation of this document, and indicate the need for additional worker protection measures during BWPS construction activities.

Intrusive activities for this project include trenching, excavation, drilling, or sheet pile driving. The Barrier Wall Alignment Investigation project indicated the extent of waste materials to be contained by the barrier wall, and directed the placement of the barrier wall to confine groundwater and waste materials. The area around SB 127 could not be realigned, and will likely require construction in PCB-containing materials. Any materials excavated from this or other unanticipated "hot spots" should be stored separately, suitably containerized, and handling activities minimized and equipment adequately decontaminated. Employee health concerns from PCBs are confined to contact and transport risks; the vapor emissions from such materials are negligible. The use of rubber boots, heavy Nitrile (>11 mls. thick) gloves, and permeable-resistant overalls (such as Saranex), and eye and face protection will be required for any activities which will bring personnel in contact with PCB-containing materials. Adequate decontamination measures will include scrubbing with water-detergent mixtures (such as one ounce Alconox/one gallon water) and clean water rinse, and segregation, containment, and disposal of equipment and apparel intended for single use.

The potential for encountering remnant waste materials during intrusive activities, or disturbing media with the potential to emit volatile organic compounds (VOCs) exists for the entirety of anticipated intrusive activities. Therefore, real-time monitoring of breathing zone atmospheres will be required once every hour during intrusive BWSP construction activities. The use of a photoionization detector (PID) with a minimum 11.7 eV lamp or flame ionization detector (FID), calibrated to a suitable (such as isobutylene) ionizable compound daily will facilitate adequate field screening for VOC atmospheres. As discussed in Section 5 of the original SSP, any readings above background will necessitate the use of respiratory protection by affected employees.

Noise and biological hazards are addressed in section 4 of the original SSP. The SOP for temperature stress is found in Appendix E of the original SSP, and general hazards specific to construction activity are addressed in Appendix F of the original SSP.

All trenching and excavation activities will be conducted in accordance with 29 CFR Subpart P. Safety precautions to be used during excavation and trenching activities are summarized below.

- Safety rules for heavy equipment and traffic discussed in Section 4 of the original SSP will be followed.

- All utilities will be cleared as discussed in Section 4 of the original SSP.

- Air monitoring for VOCs will be performed as described in this amendment. Dust suppression by water spray will be implemented for any dust generated during invasive activities. Dust suppression will eliminate the need to conduct real time air sampling for contaminants that adhere to dust.

- No trench or excavation will be left unattended or open without adequate barricades, caution tape, and warning signs.

- Personnel and equipment will maintain a minimum two foot clearance from the edge of any excavation or trench.

- Subcontractor employees will enter trenches greater than 4 feet in depth during this project. A health and safety plan will be written by the subcontractor performing the trenching work and submitted as an addendum to this health and safety plan.

- Work areas will be kept free of materials, obstructions, and substances that could cause a surface to become slick or otherwise hazardous.

- Unattended excavations must be properly covered or otherwise secured when work is not active.

- Soil shall be backfilled as soon as possible.

Electrical work will be performed only by a trained, experienced, and licensed electrical subcontractor, and will conform with 29 CFR 1910.147.

Sheet pile installation will be performed by an experienced subcontractor licensed in Indiana. Clearance of the height of vertical sheet pile plus twenty feet will be maintained for all overhead utilities in the vicinity of sheet pile driving activities.

General health and safety procedures will be included as Appendix E (to be submitted with the 100 Percent Design Submittal). Guidance for the safe operation of industrial trucks, cranes, power tools, and welding and electrical equipment will be included in Appendix E.

7.4 TASK-SPECIFIC LEVELS OF PROTECTION

The initial level of employee personal protection ensemble is Level D (coveralls or long pants and long-sleeved shirt, hard hat, safety glasses, and steel-toed boots). Action levels for upgrading personal protective equipment (PPE) are discussed in Section 5 of the original SSP.

8.0 CONSTRUCTION QUALITY ASSURANCE PLAN

8.1 PURPOSE

This Construction Quality Assurance Plan (CQAP) has been prepared as part of the Remedial Action (RA) for the barrier wall at the ACS Site. The purpose of this CQAP is to outline the personnel and methods involved in verifying compliance with the Remedial Design and contractual and regulatory requirements.

8.2 SCOPE

Included in this CQAP are the following elements:

- Description of parties involved in completion of this phase of the RA, as well as discussions of their responsibility, authority, and qualifications.
- Description of construction quality assurance procedures used to evaluate the RA.
- Description of documentation and record keeping activities.

8.3 RESPONSIBILITY AND AUTHORITY

The organizational structure for this phase of the RA activities to be implemented at the ACS Site has been designed to facilitate communication and reporting during the execution of construction. Construction activities to be conducted within the ACS facility will require constant communication between ACS, Montgomery Watson, and the subcontractors. The key personnel tasked with quality control and oversight of construction activities for the barrier wall are listed below.

Title	Name
Principal-In-Charge	Mr. Joe Adams
Program Manager	Dr. Pete Vagt
ACS Contact	Mr. Tom Froman
Engineering Manager	Mr. Ron Schlicher
Construction Manager	Mr. Todd Lewis
Construction Superintendent	Mr. Ben McGeachy
On-Site Safety Officer	Mr. Lee Orosz
Construction Quality Assurance Inspector	Mr. Lee Orosz
Construction Quality Assurance Manager	Mr. Joe Willich

The primary responsibilities of the above listed individuals are summarized below.

8.3.1. Principal-In-Charge

The Principal-In-Charge will act as the primary liaison between the ACS Steering Committee, U.S. EPA, IDEM, and Montgomery Watson and its subcontractors. The Principal-In-Charge will be directly responsible for the contractual commitments, assuring that the necessary resources are dedicated to the project, and for the overall project quality. The Principal-In-Charge will review all pertinent documents and submittals which are part of the RD/RA work at the ACS Site, and approve all change orders or modifications to the project scope of work. The Principal-In-Charge will also certify that information contained in submissions is true accurate and complete.

8.3.2. Program Manager

The Program Manager will be responsible for generating and updating the cost, schedule, and performance reports, and providing input to the Principal-in-Charge on an as-needed basis. The Program Manager will assist the Principal-in-Charge by ensuring that the necessary resources are committed to the project. The Program Manager will also be responsible for approving the project-specific documents, task deliverables, and work plans, authorizing assignment to the project team members, and establishing and enforcing work element milestones for timely completion of RA work. The Program Manager will be the primary day-to-day link between the project personnel and the agency representative.

8.3.3. Engineering Manager

The Engineering Manager will be responsible for the successful execution and administration of all engineering-related activities. Primary engineering responsibilities include development of adequate construction documents, securing the required permits, shop drawing review, as-built drawing development, and overall conformance to the applicable regulations and work controlling documents. The Engineering Manager will be the main liaison between the field teams and engineering support teams during the construction phase.

8.3.4. Construction Manager

The Construction Manager is responsible for (1) successful execution and administration of all construction activities related to the ACS Site, (2) ensuring that all construction activities proceed in accordance with the approved construction documents, (3) ensuring that all field activities are conducted in compliance with the applicable regulatory and health and safety requirements, (4) collecting all pertinent information specified in the construction documents for submittal to the Engineering Manager, (5) resolving site problems and informing the Engineering Manager of the same, (6) approve/disapprove all material and labor costs for field work, (7) negotiate construction change orders, and (8) review all field data.

8.3.5. Construction Superintendent

The Construction Superintendent is responsible for the overall direction of the field team. The Construction Superintendent is also responsible for ensuring contractual compliance through implementation of the practices and procedures described in the contract documents, for supervision/field inspection functions, and for facilitation and integration of field activities. The Construction Superintendent will report directly to the Construction Manager.

8.3.6. On-Site Safety Officer

The On-Site Safety Officer is responsible for ensuring that the construction activities are in compliance with the approved Health and Safety Plan. The On-Site Safety Officer will hold tailgate meetings and keep the field team members informed of the site hazards. The On-Site Safety Officer will report to the Construction Manager.

8.3.7. Construction Quality Assurance (CQA) Inspector

The CQA Inspector is responsible for observing and documenting activities related to the completion of the RA. The CQA Inspector will observe and document work completed at the Site and verify that installation requirements are met. The CQA Inspector is responsible for assuring that quality assurance testing is completed in accordance with the specifications, and that elements of the RA meet the specifications.

The CQA Inspector will maintain daily reports of construction activities at the Site. Included in these reports will be a summary of the days activities, a discussion of problems encountered and their solutions, and a discussion on deviations from the approved design. Reports will also include a description of quality assurance testing activities and results. The CQA Inspector will be responsible for the oversight of any laboratory testing completed to fulfill requirements of the specifications.

8.3.8. Construction Quality Assurance (CQA) Manager

The CQA Manager is responsible for assuring that all construction activities are performed in accordance with the Construction Quality Assurance Plan (CQAP). The CQA Manager will oversee the activities of the CQA Inspector and will resolve all construction quality problems that may arise. The CQA Manager will maintain daily reports of construction activities in his files. The CQA Manager will work independently of the Construction Manager and will report construction quality problems directly to the Engineering Manager.

8.3.9. Other Montgomery Watson and Subcontractor Staff

All Montgomery Watson and subcontractor staff are responsible for complying with the construction documents, work plans, procedures, and instructions. The type of subcontractors to be used at the Site include the following:

- Well Drillers;
- Barrier Wall Subcontractor;
- Material Suppliers; and
- Geosynthetic Testing Subcontractor

The Construction Superintendent, with assistance from the Construction Manager, will provide coordination of the subcontractor activities, including contract bidding and execution, scheduling, site access, equipment and material movement, and documentation.

8.4 PRECONSTRUCTION PHASE QUALITY ASSURANCE

8.4.1. Purpose and Scope

This section presents the specific preconstruction-phase quality assurance requirements for the construction activities at the ACS Site.

8.4.2. Meeting Requirements

A preconstruction meeting will be held at the Site prior to beginning of the work associated with this phase of the RA. The preconstruction meeting will be attended by an ACS representative, a representative of the ACS Technical Committee, the Construction Manager, the Construction Superintendent, the CQA Inspector, representatives of the U.S. EPA and IDEM, and selected subcontractors. This CQAP will be reviewed along with other pertinent site documents to ensure that the responsibility of each party is well defined and understood. The Preconstruction Meeting Agenda will be prepared by Montgomery Watson and distributed to all involved parties in advance of the meeting. The meeting will be documented by the Site Manager, and minutes will be transmitted to all participants.

8.4.3. Preconstruction Checklist Items

Each of the following items must be completed prior to commencing field work:

- Montgomery Watson will provide any required permits or approvals for the barrier wall construction;
- Review of the Health and Safety Plan and worker training status;
- Identification of all project team members and listing of 24-hour telephone numbers;
- Identification of site access/restrictions;
- Verification of availability and location of utilities;
- Identification of ACS-owned utilities and features that must be permanently relocated or temporarily displaced by ACS prior to construction of the barrier wall;

- Finalization and approval of the project schedule;

- Ensure that subcontractors will be ready, under contract, and bonds and insurance will be provided in accordance with the project schedule.

Additional information on several of the checklist items is presented below.

8.4.3.1. Permits. Under the CERCLA authorization, no federal or state permits are required for any on-site activities involved as part of the construction of the barrier wall. However, permits and/or approvals may be required for off-site activities and from the local utility agencies. Montgomery Watson will coordinate the permits or approvals with local agencies in advance of the RA work.

8.4.3.2. Site Access and Restrictions. The construction activities will be coordinated in advance with the appropriate point of contact for the ACS facility (Mr. Tom Froman). Montgomery Watson will provide notification for all work planned at the Site and identify issues affecting the performance of work at the ACS facility.

8.4.3.3. Availability of Utilities. Potable water, sewer, gas and electric service will be provided by ACS and the local utility companies; however, Montgomery Watson will arrange for utility connections. Locations of underground utilities which may affect the excavation will be checked.

8.4.4. Submittals

The submittals during the preconstruction-phase will include:

- Health and Safety Plan addendum
- Applicable permits and/or approvals from local agencies

8.5 CONSTRUCTION-PHASE QUALITY ASSURANCE

8.5.1. Purpose and Scope

This section presents the specific construction phase quality assurance activities for the ACS Site.

8.5.2. Meeting Requirements

Construction Progress Meetings will be held on a weekly basis and chaired by Construction Superintendent. The primary subcontractors must send an authorized representative to each meeting.

The RPM meetings will be held as required and chaired by the U.S. EPA or their designated representative. Montgomery Watson will attend all RPM meetings during the course of this contract. Subcontractors will not be required to attend these meetings, unless requested by ACS or Montgomery Watson. The intent of the meetings will be to provide the RPM with a progress update and to work through any regulatory related issues that might hold up the progress of the work.

8.5.3. Inspection and Observation

8.5.3.1. Construction Progress and Conformance Inspections. [To be determined]

8.5.3.2. Health and Safety Compliance Inspections. For the ACS Site work, periodic health and safety inspections will be conducted by the Construction Superintendent in accordance with the Health and Safety Plan.

8.5.4. Reporting and Documentation

8.5.4.1. Daily Construction Reports. Daily construction reports summarizing inspection results will be submitted during the course of the construction. The CQA Manager will produce the daily construction reports and submit them to the Site and Engineering Managers. In turn, the Construction Manager will submit the reports to the U.S. EPA personnel. The daily reports will address the following issues:

- Weather conditions;
- Name of each subcontractor on the job that day, including number of manual workers by craft and names of non-manual workers (supervisors) at the Site;
- List name, employer, and time in and out of any visitors to the Site;

- List identity, size and type of all major pieces of equipment at the Site each day. Indicate if idle, and reason, if applicable;

- Log status of all work started and in progress, including the entity performing the work;

- Record type and quantity of materials delivered to the job;

- List any samples collected and tests performed;

- Record movement of major construction equipment to and from the job site;

- Reference any quality deficiencies or unsafe conditions, and actions taken to correct the same;

- List all tests performed at the Site. Results should be reported by the lab making the test. Note the location of the test and the report number;

- Signature of person preparing the report, including full name, title and date;

Any photographs of the construction activities will be cross referenced with observation and testing information. The photographs will serve as a pictorial record of work progress, problems, and mitigation activities. The basic file will contain color prints. Negatives will be stored in a separate file.

8.5.4.2. Field Testing Reports. Records of field and laboratory testing performed at the Site must be managed by the CQA Inspector. A summary list of test results will be prepared by the CQA Inspector on an ongoing basis, and submitted to the Construction Manager.

8.5.4.3. Progress Reports. The ACS Steering Committee will submit to the U.S. EPA signed monthly reports during the construction phase. These progress reports will include as a minimum (and as appropriate):

- A description and estimate of the percentage of the RA work completed;

- Summary of findings:

- Summary of changes made in the RA from the original plan during the reporting period;

- Summaries of contacts with representatives of the local community, public interest groups, or State government during the reporting period;

- Summary of problems or potential problems encountered during the reporting period, and actions being taken to address these problems;

- Changes in key personnel during the reporting period;

- Projected work activities for the next reporting period;

- Copies of daily reports, inspection reports, and laboratory/monitoring data;

- Comparison of working schedule to project schedule;

- Summaries of conference calls and meetings held during the reporting period between the ACS Technical Committee and the U.S. EPA.

- Copies of contractor progress reports prepared by Montgomery Watson.

8.5.4.4. Inspection Reports. Inspection Reports will be completed after each of the required inspections have occurred to document the inspections. Documentation of the inspections will be prepared by the Construction Manager and will be issued to all participants in the inspection meeting.

8.5.4.5. Record Drawings. The Construction Manager or designated representative will maintain a set of marked-up drawings which will be updated on a continuous basis. The record drawings will include as a minimum:

[To be determined]

A copy of the final record drawing will be submitted to the ACS Steering Committee at the completion of the project.

8.5.5. Sampling and Testing

[To be determined]

8.6 POST-CONSTRUCTION PHASE QUALITY ASSURANCE

8.6.1. Purpose and Scope

Post-construction phase quality assurance requirements for the ACS Site are detailed in this subsection. This phase of quality assurance will be conducted by the CQA Inspector.

8.6.2. Inspections

8.6.2.1. Prefinal Inspection. As the project is nearing completion, a prefinal inspection/meeting will be held at the Site. The prefinal inspection will be attended by a representative of the ACS Technical Committee, the Construction Manager, the Construction Superintendent, and a representative from the U.S. EPA. The prefinal inspection will consist of a walk-through inspection of the entire project area and all facilities. The prefinal inspection will determine whether the project is being completed consistent with the contract documents. Any outstanding construction items noted during the prefinal inspection will be recorded in a meeting. A prefinal inspection report will outline the outstanding construction items, actions required to resolve items, completion dates for these items, and the date for the final inspection.

8.6.2.2. Final Inspection. Upon completion of any outstanding construction items, a final inspection meeting will be held at the Site. The final inspection will be attended by a representative of the ACS Technical Committee, Construction Manager, Construction Superintendent, and a representative from the U.S. EPA. The final inspection will consist of a walk-through inspection of the entire project area and all facilities. The prefinal inspection report will be used as a checklist and will focus on the outstanding construction items.

8.6.3. Final Construction Report

Following the final inspection, a Final Construction Report will be prepared by the CQA Manager and a registered professional engineer and will be submitted to the ACS Steering Committee for submittal to the U.S. EPA. The Final Construction Report will confirm that the work has been performed in substantial compliance with the design plans and specifications. The Final Construction Report will include the following:

- Summary of construction activities;

- Data quality control reports for field activities, including sampling and analytical results and other field inspections;

- Marked-up drawings indicating any deviations in the construction work from the original design drawings;

- Photographic documentation.

8.6.4. Final Storage of Records

Final storage of the completion of the RA will be maintained in the Site Manager's files. Copies of reports and other submittals will be retained by the ACS Steering Committee and the U.S. EPA.

9.0 PERFORMANCE STANDARD VERIFICATION PLAN

9.1 INTRODUCTION

This section presents the Performance Standard Verification Plan (PSVP) that will be used to assess the performance of the Barrier Wall and associated Groundwater Extraction System (BWES) to be implemented at the ACS Site. The purpose of the PSVP is to delineate the approach to be used to measure performance of the BWES and to ensure that both short-term and long-term performance standards for this portion of the remedial action are met.

The PSVP for the BWES includes the following plans:

- A Performance Monitoring Program which delineates the field measurements to be conducted to monitor the performance of the BWES. (The monitoring program is described in the following section.)

- A Quality Assurance Project Plan (QAPP) which presents the organization, objectives, functional activities, and specific quality assurance (QA) and quality control (QC) activities associated with the BWES performance monitoring. The QAPP also describes the specific protocols to be followed for water level measurements and other field analyses. (A draft QAPP will be included as Appendix F in the 100 Percent Design Submittal.)

- A Health and Safety Plan (HSP) designed to protect on-site personnel and area residents from physical, chemical and other hazards posed while conducting the performance monitoring of the BWES. (A draft HSP will be included as Attachment A to Appendix F.)

9.2 PERFORMANCE MONITORING PROGRAM

The primary objectives of the BWES are to 1) prevent the migration of contaminants from the waste areas (specifically the Still Bottoms Pond Area and the Off-Site Containment Area) to the site boundary, 2) initiate the dewatering of the waste areas, and 3) minimize the recharge of groundwater from surrounding areas while the waste areas are being dewatered. Two sets of performance standards have been established to confirm that the stated objectives are being met. The first set of standards is quantitative in nature and provides a tool to aid in field measurement of the system's performance. These performance standards are as follows:

1. An inward gradient across the barrier wall

2. A negligible response in certain exterior monitoring wells during the barrier wall performance pump test

The second set of standards is a qualitative measurement of the system's performance. These standards will help in establishing a trend to measure the long-term performance of the BWES.

3. An initial decrease in the water level within the barrier wall which will be maintained

4. A decreasing trend in the annual volume of water pumped from the extraction system within the barrier wall

The first and third performance standards will be assessed using water level data from several existing and new piezometers; the second performance standard will be assessed by conducting the specific pump test procedure described in Section 9.2.3; and the fourth performance standard will be assessed using pump discharge data.

In addition to the above standards, performance of the BWES will be measured based on the concentrations of VOCs in the existing and proposed piezometers outside the barrier wall. In general, the data will be evaluated to confirm that there is no evidence of contaminant migration through or under the wall. The sampling and analytical protocols for the existing and proposed monitoring wells will be as specified for the quarterly monitoring program to be submitted under a separate cover.

Extracted groundwater from the BWES will be conveyed to the PGCS for treatment and subsequent discharge. Performance standards and the associated monitoring program for the treatment system are included in the PGCS PSVP which was submitted previously.

9.2.1. Water Level Measurements

Water level measurements will be taken at periodic intervals to verify that an inward gradient exists and to confirm that the water level within the barrier wall has been lowered. Figure 9-1 shows the existing and proposed piezometers that will be used for this purpose. The frequency of water level readings is shown in Table 9-1.

It is important to note that the "inward gradient" performance standard assumes that the water table outside the barrier wall will not drop significantly. This may not be the case along the northern and western portions of the barrier wall while the PGCS extraction trench is operating. The extraction trench may significantly lower the water table outside the wall in these areas and it may initially do so faster than the BWES extraction system lowers the interior water table. If this happens, the inward gradient performance standard will not be considered appropriate.

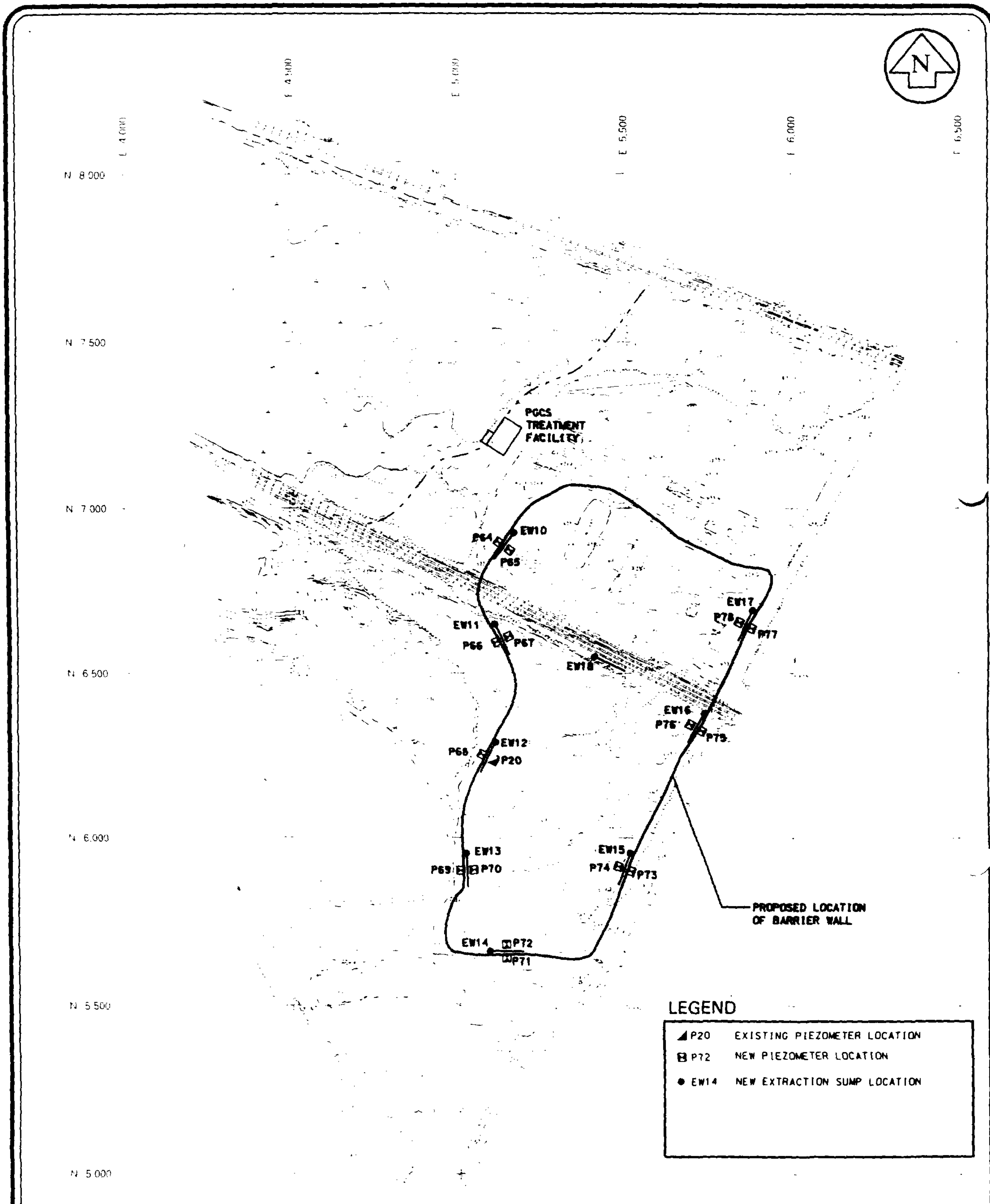
9.2.2. Extraction Pump Discharge Data

The flowrate and volume of water discharged from the groundwater extraction pumps will be used to help confirm that the barrier wall is meeting the objective of minimizing the recharge of groundwater from surrounding areas. If the pump discharge data show that the annual volume of water pumped is decreasing, and the water level data (see Section 9.2.1) demonstrate that the water level within the barrier wall has been lowered, then it can be concluded that the barrier wall is meeting this objective.

A flow meter will be installed on the common discharge line from the extraction pumps to measure the combined cumulative flow from the entire extraction system. The frequency for collecting the pump discharge data is shown in Table 9-1.

9.2.3. Barrier Wall Performance Pump Tests

Upon completing construction, the performance of the barrier wall will be assessed by conducting a pump test at each extraction trench. To conduct the pump test, two piezometers will be installed at each extraction sump location: one piezometer will be 20 feet from the sump toward the interior of the Site and the other piezometer will be 10 feet outside the wall as shown in Figure 9-1.



Shown location of barrier wall is preliminary. Final alignment of the barrier wall will be determined after design meetings with ACS and physical verification and staking in the field.

AMERICAN CHEMICAL SERVICE, INC.
NPL SITE - GRIFFITH, INDIANA

BWES PERFORMANCE MONITORING POINTS

FIGURE 9-1

TABLE 9-1

BWES MONITORING PROGRAM

Cumulative Time from Startup	Monitoring Point	Monitoring Requirement	Frequency
0-7 days	P-20 and P-64 thru P-78	Measure water levels	Once per day
	EW-10 thru EW-18	Measure water levels	Once
	EW-10 thru EW-18 discharge lines and common discharge line	Read totalized and instantaneous flow	Once per day
8-30 days	P-20 and P-64 thru P-78	Measure water levels	Once per week
	EW-10 thru EW-18	Measure water levels	Once per week
	EW-10 thru EW-18 discharge lines and common discharge line	Read totalized and instantaneous flow	Once per week
31-90 days	P-20 and P-64 thru P-78	Measure water levels	Once per month
	EW-10 thru EW-18	Measure water levels	Once per month
	EW-10 thru EW-18 discharge lines and common discharge line	Read totalized and instantaneous flow	Once per month
90 days onward	P-20 and P-64 thru P-78	Measure water levels	Once per quarter
	EW-10 thru EW-18	Measure water levels	Once per quarter
	EW-10 thru EW-18 discharge lines and common discharge line	Read totalized and instantaneous flow	Once per month

A 72-hour pump test will then be conducted at each location. The performance of the barrier wall will be evaluated by measuring water levels in the piezometers. If the water level in the outside piezometer drops more than 0.1 feet (adjusted for outside influences) while the extraction system is operating, the barrier wall will be deemed as having failed the performance test. Water levels in other piezometers outside the influence of the pump tests will also be monitored to verify that barometric pressure or other factors are not causing water level fluctuations in excess of 0.1 feet. If the water level in the inside piezometer does not drop more than 0.1 feet during the pump test, then the test will be considered unrepresentative. Details of the pump test are to be included in the QAPP in Appendix F (to be provided with the 100 Percent Design Submittal).

APPENDIX A

BARRIER WALL
PERFORMANCE SPECIFICATION AND DRAWINGS

BARRIER WALL PERFORMANCE SPECIFICATION

1.1 BARRIER WALL OBJECTIVE

The objective of the barrier wall is to provide a continuous, vertical, hydraulic cutoff wall encompassing substantially all known subsurface wastes, as well as the higher concentrations of contaminated groundwater. The constructed low hydraulic conductivity barrier wall, keyed into a natural low hydraulic conductivity clay stratum, will provide isolation of contaminant sources during groundwater pump and treat remediation inside and outside the barrier wall. To limit groundwater inflow during interior pumping and contaminant migration during exterior pumping, the barrier wall should have a design hydraulic conductivity of 1×10^{-7} cm/s or less. The barrier wall must be designed to maintain its low hydraulic conductivity, subject to the known contaminants and concentrations, for an extended period of time. Pump and treat operations inside the barrier wall may result in isolated or broad areas that are completely dewatered to the top of the clay confining stratum, resulting in a potential of 30 feet of hydraulic head (and thus gradient) on the outside of the barrier wall.

1.2 PERFORMANCE

The barrier wall shall be keyed into the clay confining layer, to an adequate depth, designed by the Bidder, to maintain a vertical barrier. The barrier wall shall not fully penetrate the confining layer, or cause the migration of groundwater between the upper and lower aquifers.

The barrier wall must be at a minimum able to demonstrate performance in meeting the objective stated herein for a period of five years beyond construction completion.

Barrier wall performance testing and monitoring shall be conducted on behalf of the ACS Executive Committee. Groundwater extracted during the performance monitoring will be managed on site on behalf of the ACS Executive Committee. The CONTRACTOR may observe performance monitoring at his choice.

1. Following construction, a three-well monitoring system will be installed at no greater than 500-foot intervals along the barrier wall alignment.

BARRIER WALL PERFORMANCE SPECIFICATION

1.1 BARRIER WALL OBJECTIVE

[illegible] on a [illegible] basis

The objective of the barrier wall is to provide a continuous, vertical, hydraulic cutoff wall encompassing substantially all known subsurface wastes, as well as the higher concentrations of contaminated groundwater. The constructed low hydraulic conductivity barrier wall, keyed into a natural low hydraulic conductivity clay stratum, will provide isolation of contaminant sources during groundwater pump and treat remediation inside and outside the barrier wall. To limit groundwater inflow during interior pumping and contaminant migration during exterior pumping, the barrier wall should have a design hydraulic conductivity of 1×10^{-7} cm/s or less. The barrier wall must be designed to maintain its low hydraulic conductivity, subject to the known contaminants and concentrations, for an extended period of time. Pump and treat operations inside the barrier wall may result in isolated or broad areas that are completely dewatered to the top of the clay confining stratum, resulting in a potential of 30 feet of hydraulic head (and thus gradient) on the outside of the barrier wall.

Also, cont conc will be monitored outside the wall on a reg. basis.

Statement [illegible]

1.2 PERFORMANCE

The barrier wall shall be keyed into the clay confining layer, to an adequate depth, designed by the Bidder, to maintain a vertical barrier. The barrier wall shall not fully penetrate the confining layer, or cause the migration of groundwater between the upper and lower aquifers.

The barrier wall must be at a minimum able to demonstrate performance in meeting the objective stated herein for a period of five years beyond construction completion.

why five yrs what happens after this period?

Barrier wall performance testing and monitoring shall be conducted on behalf of the ACS Executive Committee. Groundwater extracted during the performance monitoring will be managed on site on behalf of the ACS Executive Committee. ~~The CONTRACTOR may observe performance monitoring at his choice.~~ delete

how

1. Following construction, a three-well monitoring system will be installed at no greater than 500-foot intervals along the barrier wall alignment.

Additional locations may be chosen based on observations during construction oversight.

2. At each monitoring location, the middle well will be installed approximately 10 feet inside the barrier wall. Another well will be installed approximately 10 feet outside the barrier wall. The third well will be installed further inside the barrier wall, in line and equidistant with the other two wells. The wells will extend to the top of the clay confining layer, and be screened across the static water table. The middle well will be used as a pumping test well, while the outer wells will be used to observe the difference in groundwater elevation during pumping. [The performance test has been modified slightly since this performance specification was issued. The latest revision is presently in the PSVP in Section 9.0 of this document.]

3. A minimum 72-hour pumping test will be performed at each performance monitoring location. The pumping flow rate will be adjusted to maintain maximum drawdown. A tracer may be introduced into the outer well prior to or during pumping.

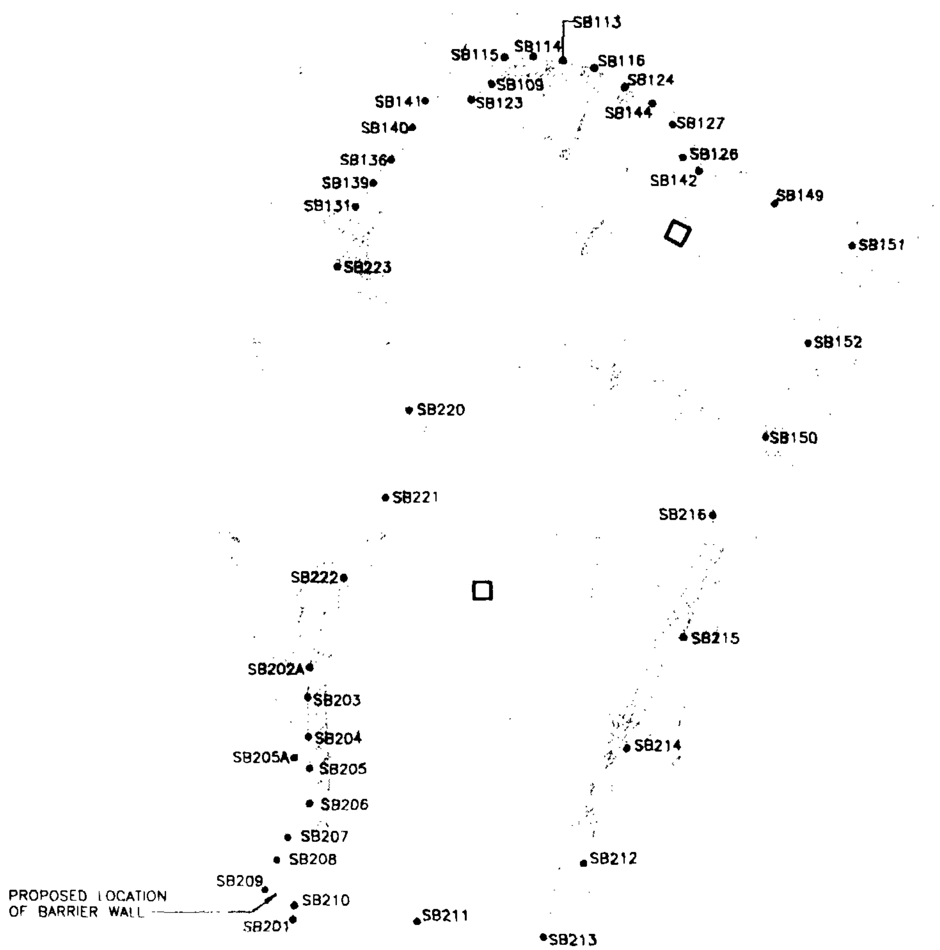
4. The barrier wall will be considered to have failed the performance monitoring test if there is an indication of significant drawdown or increased groundwater flow at the outer well. Significant drawdown will be defined as the water level in the outer well dropping more than 0.1 foot during the pumping test. If the water level in the inner monitoring well does not drop more than 0.1 foot during the pumping test, the test will be considered unrepresentative. The test may be repeated at the discretion of the ACS Executive Committee, or one or more new wells may be installed if there is suspicion that the existing wells are clogged or otherwise unrepresentative.

5. In the event of a failing performance test, the CONTRACTOR may request that the ACS Executive Committee or their representative perform a second pumping test to confirm the results of the first test. The CONTRACTOR shall bear all costs associated with tests after a failure is indicated. Otherwise, the CONTRACTOR shall take the actions specified

in the warranty and/or guarantee to repair or reconstruct the barrier wall to the satisfaction of the ACS Executive Committee at the CONTRACTOR's sole cost and expense.

6. The barrier wall will be monitored at the discretion of the ACS Executive Committee. If failures are found during the warranty period, the CONTRACTOR shall repair/replace the barrier wall at CONTRACTOR's sole cost and expense.

7. An alternative to pumping tests, in the case of soil enhanced systems, will be the direct sampling of the installed wall material and laboratory testing for hydraulic conductivity. Samples would be expected to be retrieved with standard soil drilling equipment.



LEGEND

- PILOT TEST CELL
- SB222 BARRIER WALL SOIL BORING LOCATION AND NUMBER
- APPROXIMATE LOCATION OF BARRIER WALL
- RAILROAD TRACK
- TOPOGRAPHIC CONTOUR

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. VERTICAL DATUM IS U.S.G.S. DATUM. CONTOUR INTERVAL IS 2 FEET.
3. APPROXIMATE BARRIER WALL LOCATION IS BASED ON RESULTS OF SOIL BORING PROGRAM. FINAL LOCATION WILL BE DETERMINED DURING DESIGN. △
4. SOIL BORINGS PERFORMED JANUARY 17, 1996 THROUGH FEBRUARY 12, 1996, BY ENVIRONMENTAL AND FOUNDATION DRILLING.
5. SOIL BORING ELEVATIONS AND LOCATIONS SURVEYED ON FEBRUARY 12 AND 16, 1996, BY AREA SURVEY.

north

0 200 400

SCALE IN FEET

FIGURE 2

Developed By PJV
Drawn By DLF,LCL
Approved By
Date
Reference
Revisions △ MODIFIED NOTE 3. 8/28/96-LCL/RHW

BARRIER WALL ALIGNMENT

BARRIER WALL ALIGNMENT INVESTIGATION
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number
4077.0075 B2

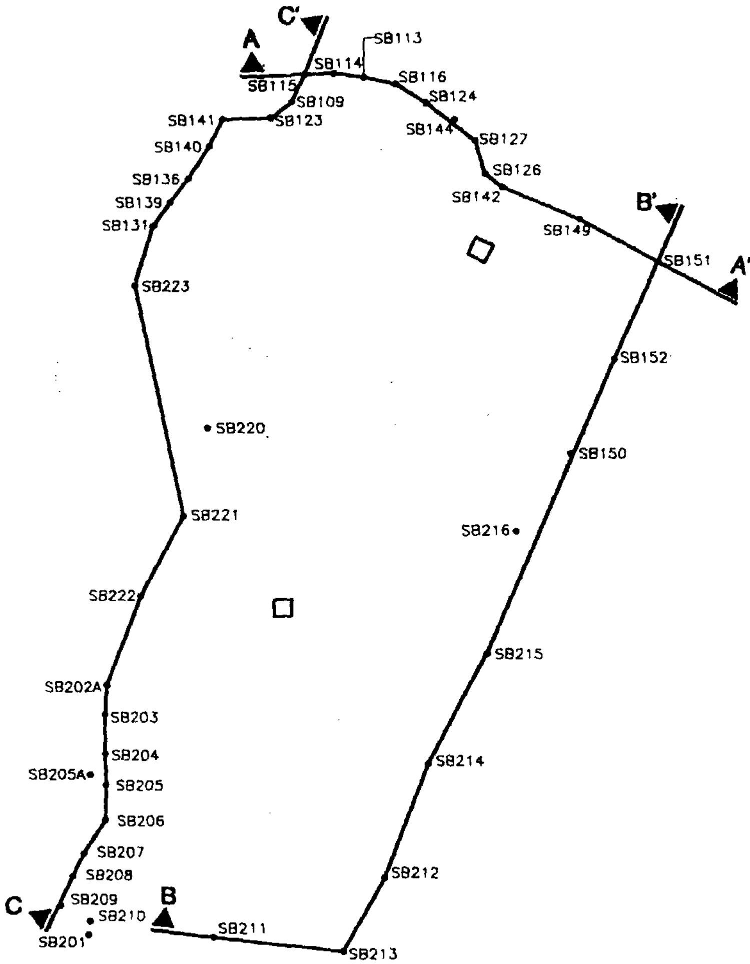
MONTGOMERY WATSON

QUALITY CONTROL
Graphic Standards
Lead Professional
Technical Review
Project Manager
Management Review
Other

This document has been developed for a specific application and may not be used without the written approval of Montgomery Watson.

LEGEND

- PILOT TEST CELL
- SB222 BARRIER WALL SOIL BORING LOCATION AND NUMBER
- RAILROAD TRACK
- TOPOGRAPHIC CONTOUR
- A CROSS SECTION LOCATION



NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. VERTICAL DATUM IS U.S.G.S. DATUM. CONTOUR INTERVAL IS 2 FEET.
3. SOIL BORINGS PERFORMED JANUARY 17, 1996 THROUGH FEBRUARY 12, 1996, BY ENVIRONMENTAL AND FOUNDATION DRILLING.
4. SOIL BORING ELEVATIONS AND LOCATIONS SURVEYED ON FEBRUARY 12 AND 16, 1996, BY AREA SURVEY.

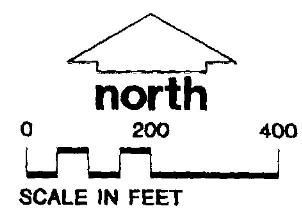


FIGURE 3

CROSS SECTION LOCATION MAP

BARRIER WALL ALIGNMENT INVESTIGATION
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

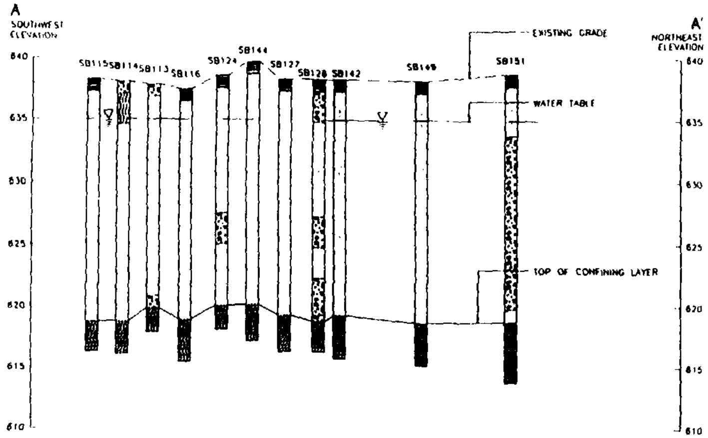
Developed By PJV
Approved By PJV
Drawn By DLF
Date 3/28/96
Reference
Revisions

Drawing Number 4077.0075 B3

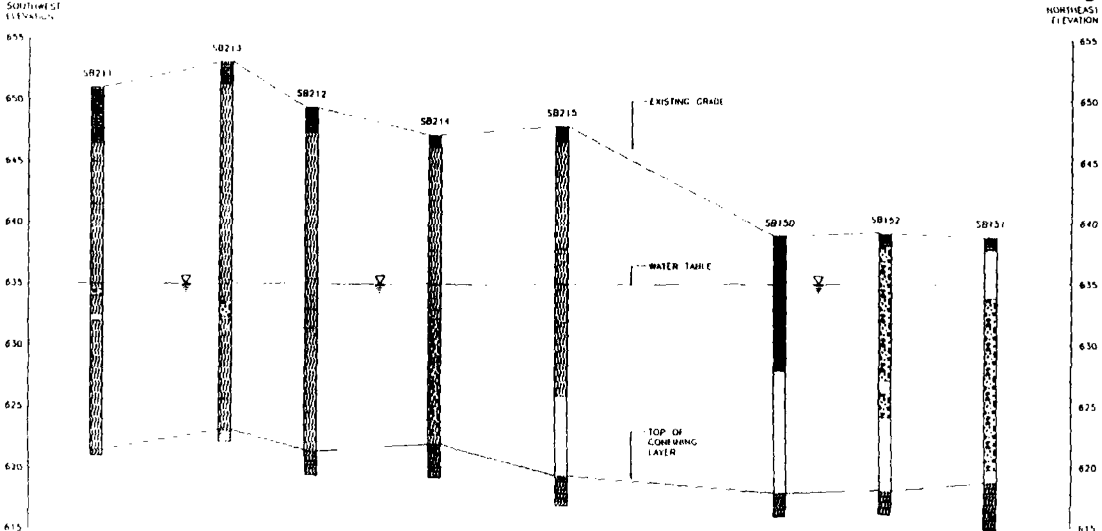
MONTGOMERY WATSON

QUALITY CONTROL | Graphic Standards | Lead Professional | Technical Review | Project Manager | Management Review | Other

This document has been developed for a specific application and may not be used without the written approval of Montgomery Watson.



SECTION A-A'



SECTION B-B'

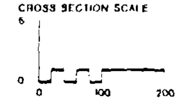
LEGEND

- SAND WITH LOW SILT AND CLAY CONTENT (SP OR SW). MAY ALSO INCLUDE SW SM, SW-SC, SP-SM AND SP SC
- SILTY SAND (SM). MAY ALSO INCLUDE SP SM AND SW SM
- SAND AND GRAVEL WITH LOW SILT AND CLAY CONTENT (SP/GP OR SW/GW). MAY ALSO INCLUDE SW SM/GW GM SW SC/GW GC SP-SM/GP-GM, AND SP SC/GP-GC
- SAND AND GRAVEL, SOME SILT (SM/GM). MAY ALSO INCLUDE SW-SM/GW-GM SP-SM/GP-GM AND SM/GM
- TOPSOIL
- FILL
- REFUSE
- SILT, NON PLASTIC OR LOW PLASTICITY (ML)
- SILTY CLAY, LOW PLASTICITY (CL-ML)
- LEAN CLAY, MODERATE PLASTICITY (CL)
- WATER TABLE

NOTES

1. THE STRATUM LINES ARE BASED ON INTERPOLATION BETWEEN BORINGS AND MAY NOT REPRESENT ACTUAL SUBSURFACE CONDITIONS
2. FOR THE PURPOSE OF ILLUSTRATING SUBSOIL CONDITIONS ON THE CROSS SECTIONS SOME OF THE BORING LOGS HAVE BEEN SIMPLIFIED FOR A DETAILED DESCRIPTION OF SUBSURFACE CONDITIONS AT INDIVIDUAL BORINGS, REFER TO SOIL BORING LOGS, APPENDIX B OF TEXT
3. HORIZONTAL DISTANCES ARE MEASURED WITH RESPECT TO THE CENTER OF EACH SOIL BORING LOCATION
4. EXISTING GROUND SURFACE WAS TAKEN FROM DRAWING 4077.0075 B3 FIGURE 3
5. ELEVATIONS ARE SHOWN IN REFERENCE TO U.S.G.S. DATUM
6. WATER TABLE ELEVATIONS ARE AN AVERAGE WATER LEVEL THAT WAS CALCULATED FROM WATER LEVELS OBSERVED DURING THE RI FROM AUGUST 17 1989 TO SEPTEMBER 13, 1990
7. SOIL BORINGS PERFORMED JANUARY 17 1996 THROUGH FEBRUARY 12 1996, BY ENVIRONMENTAL AND FOUNDATION DRILLING
8. SOIL BORING ELEVATIONS AND LOCATIONS SURVEYED ON FEBRUARY 12, AND 16 1996, BY AREA SURVEY

CROSS SECTION SCALE

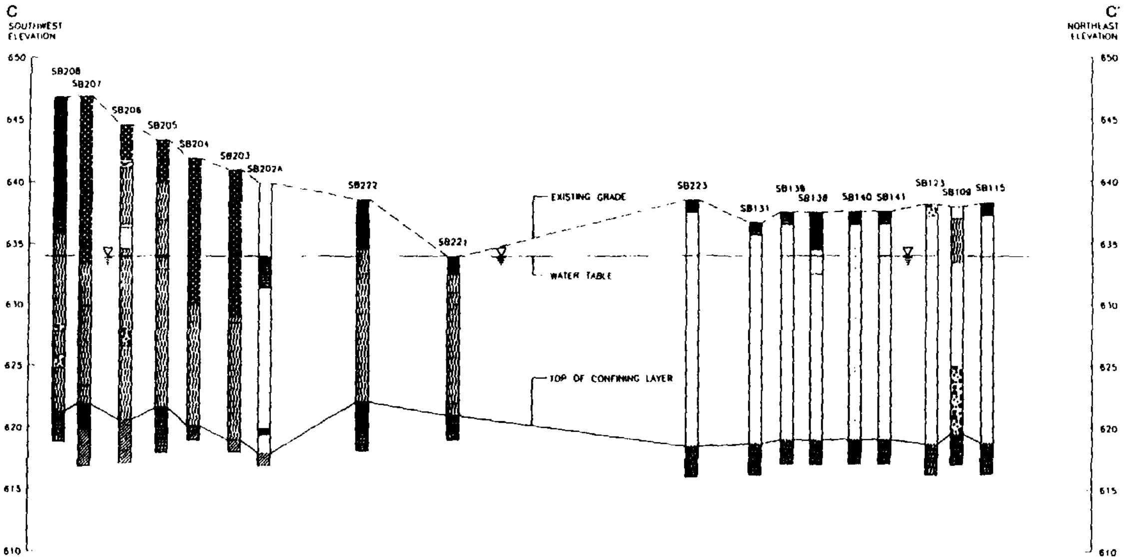


SCALE IN FEET
VERTICAL EXAGGERATION TWENTY TIMES

CROSS SECTION A-A'
CROSS SECTION B-B'

MONTGOMERY WATSON

FIGURE 4



SECTION C-C'

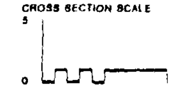
LEGEND

- SAND WITH LOW SILT AND CLAY CONTENT (SP OR SW). MAY ALSO INCLUDE SW SM, SW SC, SP SM AND SP-SC
- SILTY SAND (SM). MAY ALSO INCLUDE SP SM AND SW-SM
- SAND AND GRAVEL WITH LOW SILT AND CLAY CONTENT (SP/GP OR SW/GW). MAY ALSO INCLUDE SW SM/GW GM, SW SC/GW-GC, SP-SM/GP-GM, AND SP-SC/GP GC
- SAND AND GRAVEL, SOME SILT (SM/GM). MAY ALSO INCLUDE SW SM/GW-GM, SP-SM/GP-GM AND SM/GM
- TOPSOIL
- FILL
- REFUSE
- SILT NON-PLASTIC OR LOW PLASTICITY (ML)
- SILTY CLAY, LOW PLASTICITY (CL-ML)
- LEAN CLAY MODERATE PLASTICITY (CL)
- ▽ - WATER TABLE

NOTES

1. THE STRATUM LINES ARE BASED ON INTERPOLATION BETWEEN BORINGS AND MAY NOT REPRESENT ACTUAL SUBSURFACE CONDITIONS
2. FOR THE PURPOSE OF ILLUSTRATING SUBSOIL CONDITIONS ON THE CROSS SECTIONS, SOME OF THE BORING LOGS HAVE BEEN SIMPLIFIED FOR A DETAILED DESCRIPTION OF SUBSURFACE CONDITIONS AT INDIVIDUAL BORINGS, REFER TO SOIL BORING LOGS, APPENDIX B OF TEXT
3. HORIZONTAL DISTANCES ARE MEASURED WITH RESPECT TO THE CENTER OF EACH SOIL BORING LOCATION
4. EXISTING GROUND SURFACE WAS TAKEN FROM DRAWING 4077 0075-B3, FIGURE 3
5. ELEVATIONS ARE SHOWN IN REFERENCE TO U.S.G.S. DATUM
6. WATER TABLE ELEVATIONS ARE AN AVERAGE WATER LEVEL THAT WAS CALCULATED FROM WATER LEVELS OBSERVED DURING THE RI FROM AUGUST 17, 1989 TO SEPTEMBER 13, 1990
7. SOIL BORINGS PERFORMED JANUARY 17, 1996 THROUGH FEBRUARY 12 1996, BY ENVIRONMENTAL AND FOUNDATION DRILLING
8. SOIL BORING ELEVATIONS AND LOCATIONS SURVEYED ON FEBRUARY 12, AND 16, 1996, BY AREA SURVEY

CROSS SECTION SCALE



SCALE IN FEET
VERTICAL EXAGGERATION TWENTY TIMES

CROSS SECTION C-C

D2

MONTGOMERY WATSON

FIGURE 5

APPENDIX B

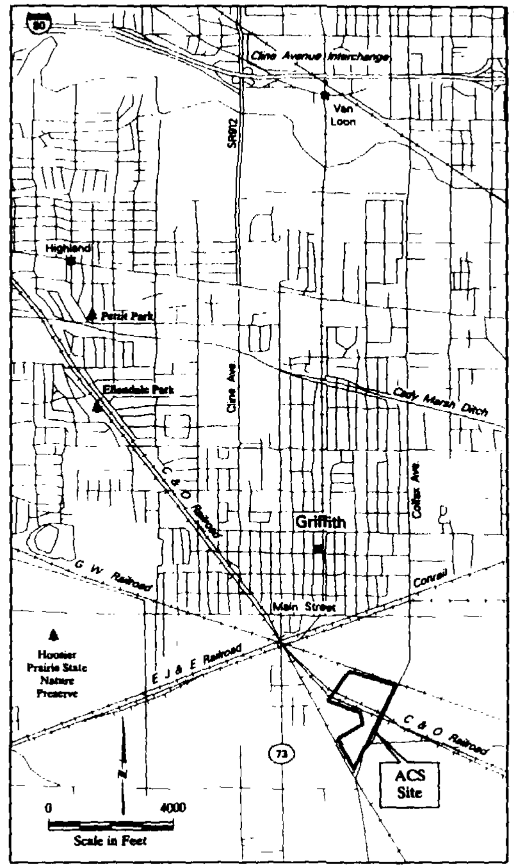
EXTRACTION SYSTEM AND PERFORMANCE MONITORING SYSTEM DRAWINGS

American Chemical Service, Inc. NPL Site
Barrier Wall Extraction System
Griffith, Indiana

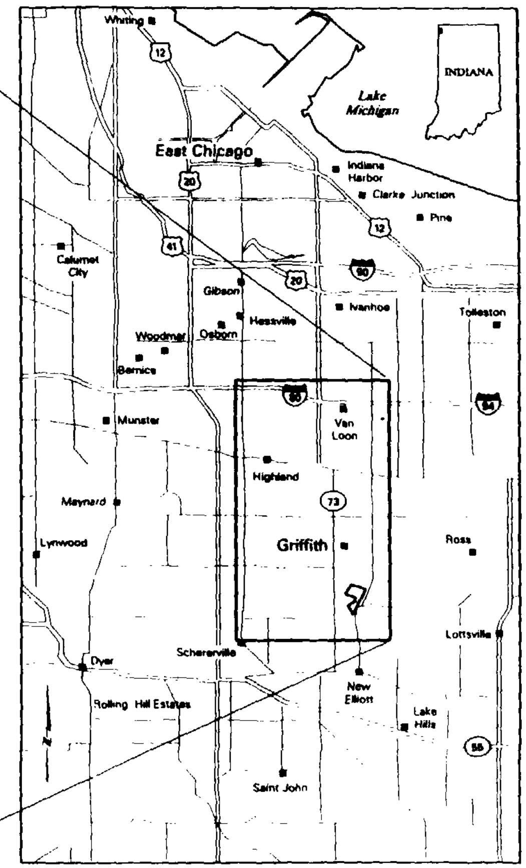
INDEX OF DRAWINGS

SHEET NUMBER	DRAWING TITLE
GENERAL	
G-1	Title Sheet, Index of Drawings, Vicinity Map, Site Location Map
G-2	General Notes, Symbols and Legend
G-3	Standard Abbreviations
CIVIL	
C-1	Overall Site Plan
C-2	Extraction System Layout - 1
C-3	Extraction System Layout - 2
C-4	Extraction Trench/ Piezometer Sections and Details
MECHANICAL	
M-1	Sump and Vault - Plan, Sections and Details
M-2	Equipment Schedule

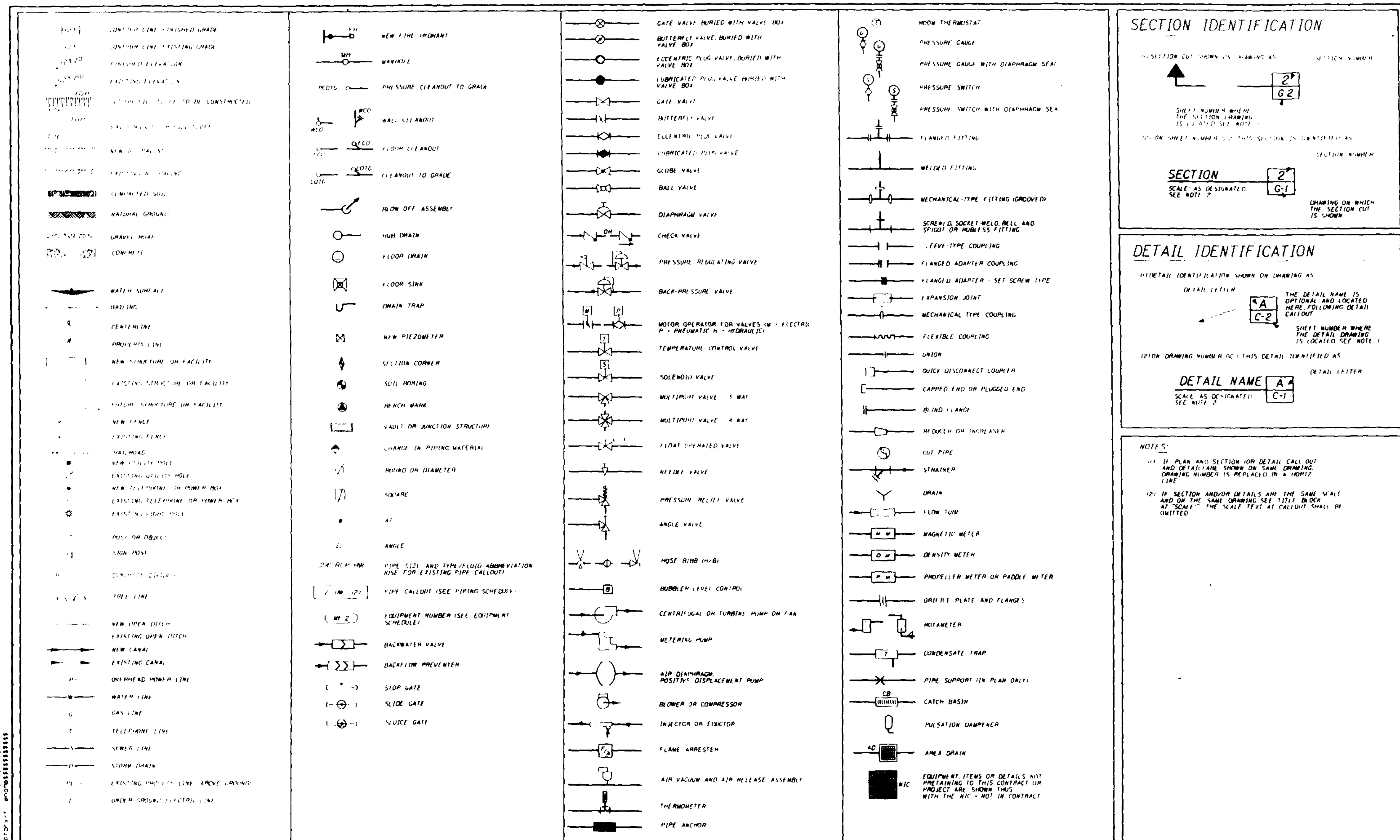
VICINITY MAP



SITE LOCATION MAP



SCALE	WARNING 0 ½ 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE	DESIGNED V. AGRAWAL DRAWN E. SCOTT CHECKED	SUBMITTED PROJECT ENGINEER R.C.E. NO. DATE MONTGOMERY WATSON CONSULTING ENGINEERS, INC. R.C.E. NO. DATE	MONTGOMERY WATSON Salt Lake City, Utah	APPROVED DATE APPROVED DATE	AMERICAN CHEMICAL SERVICE, INC. GRIFFITH, INDIANA BARRIER WALL EXTRACTION SYSTEM TITLE SHEET, INDEX OF DRAWINGS, VICINITY MAP, SITE LOCATION MAP	SHEET G-1



REV DATE BY DESCRIPTION

SCALE: NONE

WARNING
0 ½ 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED R.F. HEATON
DRAWN E. SCOTT
CHECKED

SUBMITTED
PROJECT ENGINEER R.C.E. NO. DATE
MONTGOMERY WATSON CONSULTING ENGINEERS, INC R.C.E. NO. DATE

MONTGOMERY WATSON
Salt Lake City, Utah

APPROVED DATE
APPROVED DATE

AMERICAN CHEMICAL SERVICE, INC. GRIFFITH, INDIANA
BARRIER WALL EXTRACTION SYSTEM
GENERAL NOTES, SYMBOLS AND LEGEND

SHEET G-2 OF SHEETS

AB	ANCHOR BOLT
ABBR	ABBREVIATION
AC	ACTIVATED CARBON OR ASPHALT CONCRETE
A C	AIR CONDITIONING
ACFM	ACTUAL CUBIC FEET PER MINUTE
ACOUS	ACOUSTIC OR ACOUSTICAL
ACP	ASPHALTIC CONCRETE PAVEMENT
AER	AERATION
AG	AGRICULTURAL
AIR	AIR OR COMPRESSED AIR
AL	ALUM
ALUM	ALUMINUM
AMB	AMBIENT
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE (FORMERLY ASA)
API	AMERICAN PETROLEUM INSTITUTE
APPD	APPROVED
APPROX	APPROXIMATE
ARCH	ARCHITECTURAL
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIAL
ASSY	ASSEMBLY
ATM	ATMOSPHERE OR
AVAR	AIR VACUUM AND AIR RELEASE VALVE
AWWA	AMERICAN WATER WORKS ASSOCIATION
BC	BEGIN CURVE OR BOLT CIRCLE
BCR	BEGIN CURB RETURN
BD	BOARD
BF	BLIND FLANGE
BFP	BACK FLOW PREVENTER
BHP	BRAKE HORSEPOWER
BLDG	BUILDING
BLD FLG	BLIND FLANGE
BLK	BLACK OR BLOCK
BLKG	BLOCKING
BM	BEAM OR BENCH MARK
BO	BLOW OFF ASSEMBLY
BOD	BIOCHEMICAL OXYGEN DEMAND
BOT	BOTTOM
BPV	BACK PRESSURE VALVE
B & S	BELL AND SPIGOT
BSMT	BASEMENT
BTU	BRITISH THERMAL UNIT
BTUH	BRITISH THERMAL UNIT PER HOUR
BTWN	BETWEEN
BTWN CR	BETWEEN CENTERS
BV	BUTTERFLY VALVE
BVC	BEGIN VERTICAL CURVE
BWV	BACK WATER VALVE
C	CELSIUS
CAP	CAPACITY
CB	CATCH BASIN
CC	CENTER TO CENTER
CD	CEILING DIFFUSER
CFH	CUBIC FEET PER HOUR
CFM	CUBIC FEET PER MINUTE
CFS	CUBIC FEET PER SECOND
CHEM	CHEMICAL
CHK V	CHECK VALVE
CHKD PL	CHECKERED PLATE
CI	CAST IRON
CL	CENTERLINEFFU
CLR	CLEAR OR CLEARANCE
CLG	CEILING
CM	CENTIMETER PE
CML & C	CEMENT MORTAR LINED AND COATED
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNITS
CO	CLEANOUT
COL	COLUMN
CONC	CONCRETE OR CONCENTRIC
CONN	CONNECTIONICA
CONSTR	CONSTRUCTION OR CONSTRUCT
CONT	CONTINUED OR CONTINUOUS
CONTR	CONTRACTORUDS
COMP	COMPRESSORR O
COTG	CLEANOUT TO GRADE
CPLG	COUPLING
CS	CARBON STEEL
CT	CERAMIC TILE
CT STL	CAST STEEL SO
CTSK	COUNTERSUNK
CTR	CENTER
CU	CUBIC
CYL	CYLINDER
CW	CONTAMINATED WATER
CWO	CHAIN WHEEL OPERATOR
DET	DETAIL
DF	DRINKING FOUNTAIN
DG	DOOR GRILLE
DI	DUCTILE IRON
DIA	DIAMETER
DIAPH	DIAPHRAGM
DISCH	DISCHARGE
DISP	DISPENSER
DN	DOWN OR DECANT
DO	DISSOLVED OXYGEN
DR	DOOR OR DRAIN
DS	DRENCH SHOWER AND EYE WASH
DWG	DRAWING
DIFF	DIFFUSER
DIFF	DIFFERENTIAL
E	EAST
EA	EACH
EC	END CURVE
ECL	ECCENTRIC
ECR	END CURB RETURN
EF	EACH FACE
EFF	EFFLUENT
EG	EXHAUST GRILLE
EL	ELEVATION
ELEC	ELECTRICAL OR ELECTRONIC
ENG	ENGINE
EQ	EQUAL
EQUIP	EQUIPMENT
EVAP	EVAPORATOR SQ
EVC	END VERTICAL CURVE
EW	EACH WAY OR EXTRACTION WELL
EWH	EYE WASH
EXH	EXHAUST
EXHF	EXHAUST FAN
EXH	EXTRA HEAVY
EXIST	EXISTING
EXP JT	EXPANSION JOINT
EXT	EXTERIOR OR EXTENSION
F	FAHRENHEIT
FABR	FABRICATION, FABRICATE OR FABRICAT
FAI	FRESH AIR INTAKE
FB	FLAT BAR
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FD BK	FIELD BOOKE PO
FDR	FEEDER
FE	FINAL EFFLUENT
FEXT	FIRE EXTINGUISHER
FF	FLAT FACE OR FAR FACE
F TO F	FACE TO FACE
FG	FINISHED GRADE
FH	FIRE HYDRANT
FIG	FIGURE
FIN	FINISH OR FINISHED
FL	FLOWLINE
FLEX	FLEXIBLE
FLOCC	FLOCCULATOR OR FLOCCULATION
FLG	FLANGE
FLGD	FLANGED
FLR	FLOOR
FLR BM	FLOOR BEAMIDE
FMH	FLEXIBLE METAL HOSE
FOC	FACE OF CONCRETE
FOM	FACE OF MASONRY
FOS	FACE OF STUDS
FOW	FACE OF WALL
FPC	FLEXIBLE PIPE COUPLING
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FRP	FIBERGLASS REINFORCED PLASTIC
FS	FAR SIDE, FLOOR SINK, FINISHED SURFACE, FORGED STEEL OR FROTH SPRAY
FT	FEET OR FOOT
FTG	FOOTING
FUT	FUTURE
GA	GAGE OR GAUGE
GAL	GALLON
GALV	GALVANIZEDEUH
GEN	GENERAL OR GENERATOR
GFA	GROOVED FLANGE ADAPTER
GI	GALVANIZED IRON
GLV	GLOBE VALVE
GPD	GALLONS PER DAY
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GRD	GRADE OR GROUND
GR BRK	GRADE BREAK OR GRADE CHANGE
GV	GATE VALVE
GYP	GYPSUM
H	HEIGHT
H/B	HOSE BIBB
HDPE	HIGH DENSITY POLYETHYLENE
HDR	HEADER
HEX	HEXAGONAL
HG	MERCURY
HORIZ	HORIZONTALTUR
HP	HORSEPOWER
HPR	HIGH PRESSURE
HR	HEATING RETURN OR HOUR
HTG	HEATING
HTR	HEATER
H & V	HEATING AND VENTILATING
HVAC	HEATING, VENTILATING AND AIR CONDITIONING
HWO	HANDWHEEL OPERATED
HYD	HYDRAULIC OR HYDRANT
ICFM	INLET CUBIC FEET PER MINUTE
ID	INSIDE DIAMETER
IF	INSIDE FACE
IN	INCH
INFL	INFLUENT
INSL	INSULATION OR INSULATED
INSTR	INSTRUMENT OR INSTRUMENTATION
INV	INVERT
IP	IRON PIPE
IPS	IRON PIPE SIZE
IRRG	IRRIGATIOND V
JAN	JANITOR
JT	JOINT
KG	KILOGRAM
KM	KILOMETER
KV	KILOVOLT
KW	KILOWATT
KWH	KILOWATT HOUR
L	LITER OR LENGTH
LAV	LAVATORY
LB	POUND
LEV	LEVEL
LG	LONG
LO	LEVER OPERATED
LP	LIGHT POLEBE
LPV	LUBRICATED PLUG VALVE
LT	LEFT
LWR	LOWER
LGTH	LENGTH
M	METER
MAG	MAGNETIC
MAN	MANUAL
MACH	MACHINE
MAX	MAXIMUM
MCC	MOTOR CONTROL CENTER
MECH	MECHANICALEIE
MFR	MANUFACTURER
MGD	MILLION GALLONS PER DAY
MH	MANHOLE
MI	MALLEABLE IRON
MIN	MINIMUM OR MINUTE
MISC	MISCELLANEOUS
MK	MARK
MO	MOTOR OPERATED OR MASONRY OPENING
MOD	MODEL
MS	MOP SINK
MTC	MECHANICAL-TYPE COUPLING
MTD	MOUNTED
MTL	MATERIAL OR METAL
MTR	MOTOR
N	NORTH
NBS	NATIONAL BUREAU OF STANDARDS
NC	NORMALLY CLOSED
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NF	NEAR FACE
NIC	NOT IN CONTRACT
NO	NUMBER OR NORMALLY OPEN
NPS	NOMINAL PIPE SIZE (FORMERLY I.P.S.)
NPT	NATIONAL PIPE THREAD
NRS	NON-RISING STEM
NS	NEAR SIDE LOS
NTS	NOT TO SCALE
OC	OVER-CROSSING OR ON CENTER
OD	OUTSIDE DIAMETER
OF	OVERFLOW OR OUTSIDE FACE
OH	OVER HEAD
OPER	OPERATOR OR OPERATING
OPNG	OPENING
OS & Y	OUTSIDE SCREW AND YOKE
OZ	OUNCE
P	POLE OR PAGE
PAVMT	PAVEMENT
PC	PRIMARY CLARIFIER OR PORTLAND CEMENT
PCOTG	PRESSURE CLEANOUT TO GRADE
PE	POLYELECTROLYTE OR POLYMER
PEF	PLANT EFFLUENT
PG	PRESSURE GAGE
pH	HYDROGEN ION CONCENTRATION
PI	PLANT INFLUENT OR POINT OF INTERSECTION
PL	PLATE, PROPERTY LINE OR PLACE
PLAS	PLASTER OR PLASTIC
PNEU	PNEUMATIC
PP	POWER POLE
PLT	PLANT
PPD	POUNDS PER DAY
PPH	POUNDS PER HOUR
PPM	PARTS PER MILLION
PR	PAIR
PRE	PREVIOUS
PRESS	PRESSURE
PRV	PRESSURE REGULATING, RELIEF OR REDUCING VALVE
PS	PRESSURE SWITCH
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSIG	POUNDS PER SQUARE INCH GAUGE
PTDF	PRESSURE TREATED DOUGLAS FIR
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE
PW	POTABLE WATER
R	RADIUS OR RISER
RAG	RETURN AIR GRILLE
RC	REINFORCED CONCRETE
RCP	REINFORCED CONCRETE PIPE
RD	ROOF DRAIN, ROUND, OR ROAD
RDWD	REDWOOD
RED	REDUCER OR REDUCING
REF	REFERENCE OR REFER
REG	REGULATING OR
REIN	REINFORCE OR REINFORCED
RE-STL	REINFORCING STEEL
REQD	REQUIRED
RET	RETURN
REV	REVISION
RM	ROOM
ROS	RATE OF SLOPE
RPM	REVOLUTIONS PER MINUTE OR REINFORCED PLASTIC MORTAR
RR	RAILROAD
RT	RIGHT
R/W	RIGHT OF WAY
RWL	RAINWATER LEADER
S	SOUTH, SCUM, SINK, SECOND, SEWER OR SLOPE
SA	SAMPLE
SC	SPARE CHEMICAL OR SECONDARY CLARIFIER
SCD	SCREWED
SCFM	STANDARD CUBIC FEET PER MINUTE
SCH	SCHEDULE
SCHED	SCHEDULE
SDR	STORM DRAINS
SEC	SECONDARY
SECT	SECTION
SER	SERIES
SER SK	SERVICE SINK
SETT	SETTLING
SH	SHOWER
SHT	SHEET
SIM	SIMILAR
SL	SLUDGE OR SLOPE
SP	STATIC PRESSURE
SPECS	SPECIFICATIONS
SQ	SQUARE
SS	SANITARY SEWER
SSU	SECONDS SAYBOLT UNIVERSAL
STA	STATION
STC	SLEEVE TYPE COUPLING
STD	STANDARD
STL	STEEL
STN	STAINLESS
STR TRD	STAIR TREAD
STRUCT	STRUCTURAL OR STRUCTURE
SUCT	SUCTION
SV	SOLENOID VALVE
SWR	SIDEWALL REGISTER
SYM	SYMMETRICAL OR SYMBOL
SYS	SYSTEM
T	THERMOSTAT OR TANGENT
TB	TACK BOARDREW
T & B	TOP AND BOTTOM
TBC	TOP BACK OF CURB
TBE	THREAD BOTH ENDS
TBM	TEMPORARY BENCH MARK
TC	TOP OF CURB
TDH	TOTAL DYNAMIC HEAD
T & G	TONGUE AND GROOVE
THK	THICK OR THICKNESS
THRD	THREADED
THRHLD	THRESHOLD
TK	TANK
TOE	THREAD ONE END
TOG	TOP OF GRATING
TOS	TOP OF STEEL
TOW	TOP OF WALL
TP	TELEPHONE POLE OR TELEGRAPH POLE
TRANS	TRANSITION OR TRANSMITTER
TV	THERMOSTATIC VALVE
TW	THERMOMETER WELL OR TREATED WATER
TYP	TYPICAL
UBC	UNIFORM BUILDING CODE
UC	UNDER-CROSSING
UG	UNDERGROUND
UGC	UNDERGROUND CONDUIT
UH	UNIT HEATER
UL	UNDERWRITERS LABORATORIES
UNO	UNLESS NOTED OTHERWISE
UP	UTILITY POLE
UR	URINAL
V	VACUUM, VALVE, VERTICAL VENT, VOLT OR VOLUME
VAR	VARIES OR VARIABLE
VCP	VITRIFIED CLAY PIPE
VERT	VERTICAL
VOL	VOLUME
VTC	VENT TO CEILING
VTR	VENT THROUGH ROOF
W	WEST, WATER OR WIDTH
W/	WITH
WC	WATER COLUMN OR WATER CLOSET
WCO	WALL CLEANOUT
WD	WOOD
WOG	WATER, OIL, GAS
W/O	WITHOUT
WS	WATER SURFACE
WSCOT	WAINSCOT
WSTP	WATER STOPHC
WT	WEIGHT
WWM	WELDED WIRE MESH
XS	EXTRA STRONG
YD	YARD

REV	DATE	BY	DESCRIPTION

SCALE: NONE

WARNING: 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED: R.F. HEATON
DRAWN: R.F. HEATON
CHECKED:

SUBMITTED: PROJECT ENGINEER — R.C.E. NO. — DATE
MONTGOMERY WATSON CONSULTING ENGINEERS, INC — R.C.E. NO. — DATE

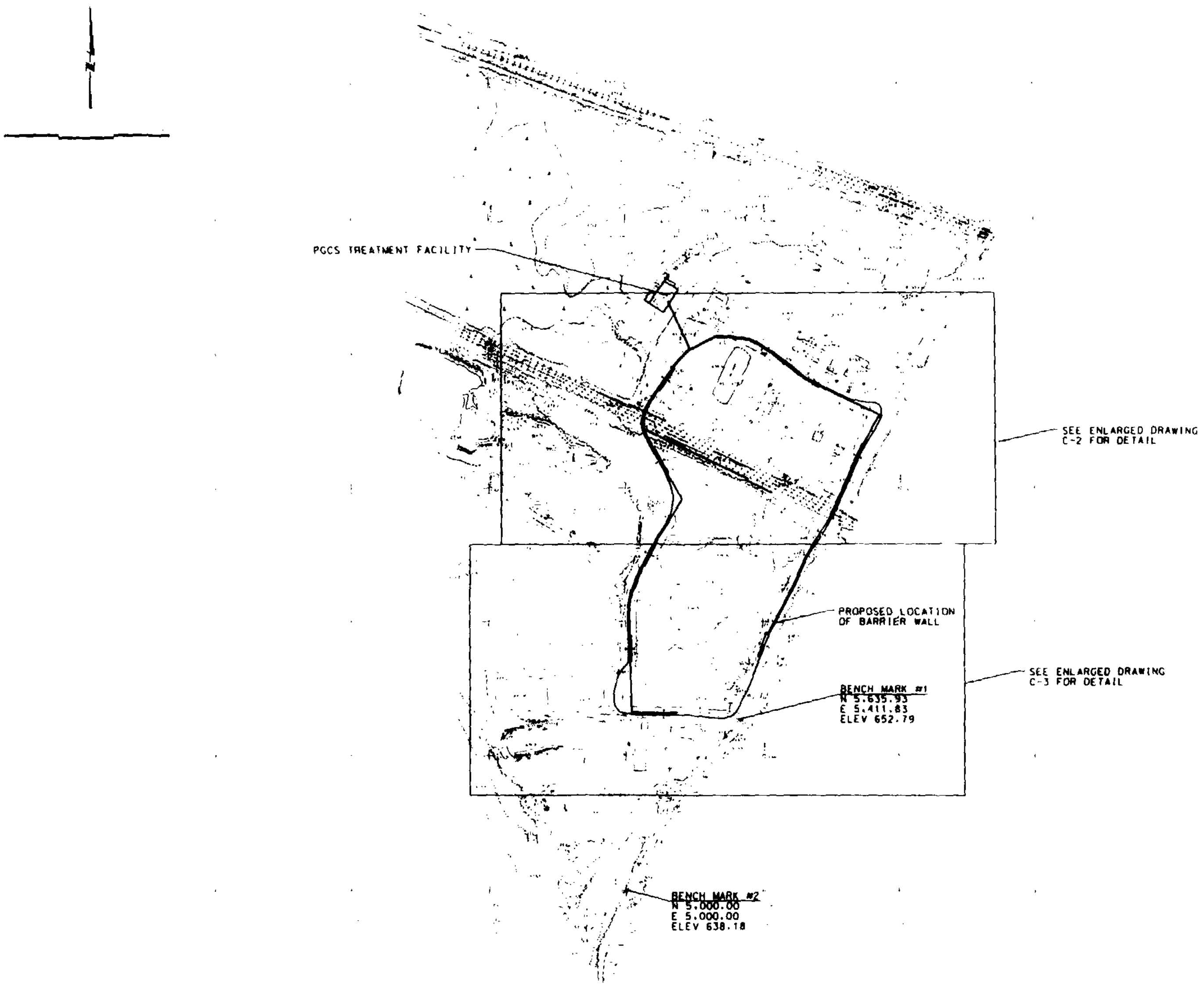
MONTGOMERY WATSON
Salt Lake City, Utah

APPROVED — DATE
APPROVED — DATE

AMERICAN CHEMICAL SERVICE, INC. GRIFFITH, INDIANA
BARRIER WALL EXTRACTION SYSTEM

STANDARD ABBREVIATIONS

SHEET G-3

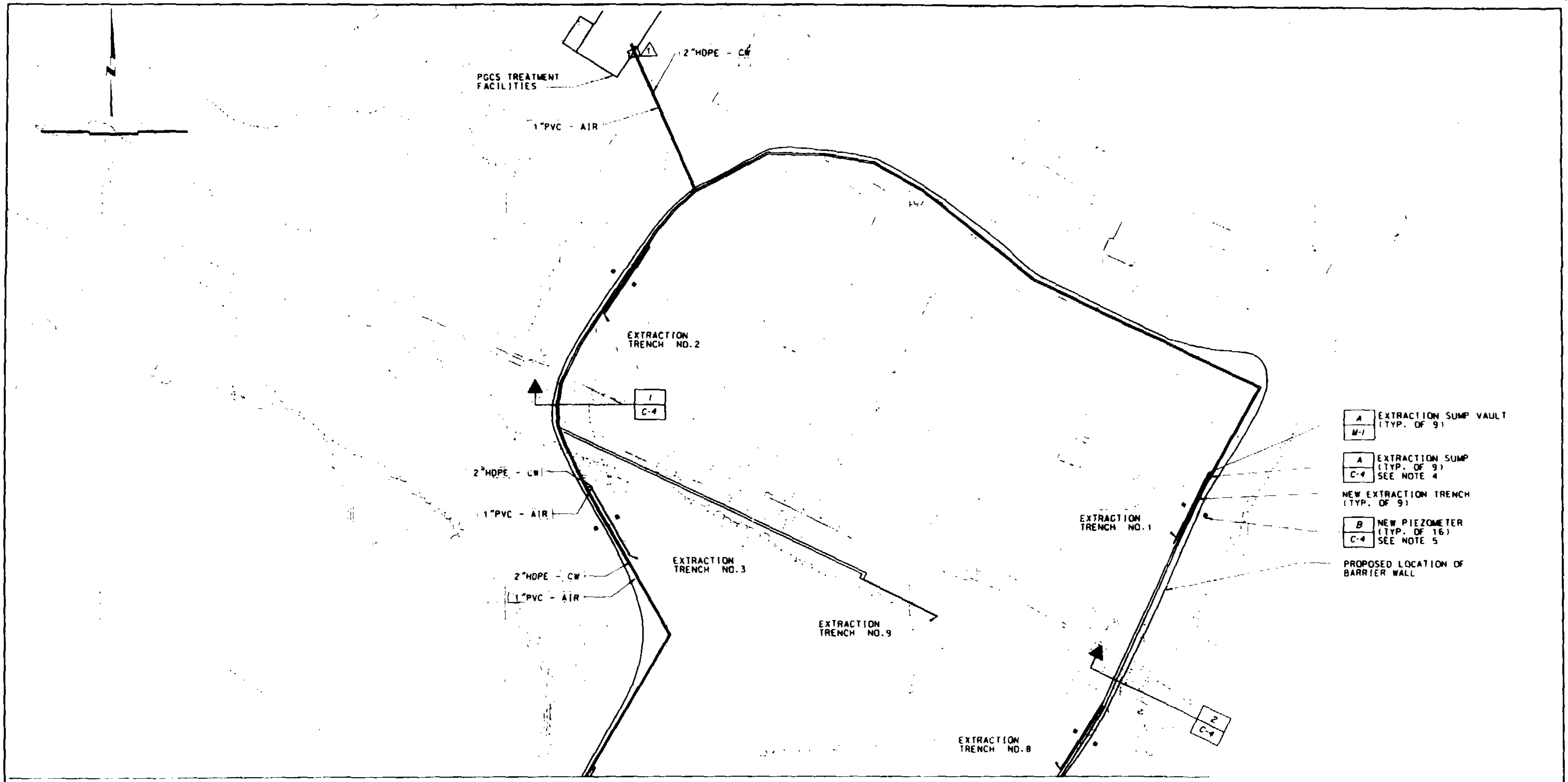


NOTES:

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. VERTICAL DATUM IS U.S.G.S. DATUM. CONTOUR INTERVAL IS 2 FEET.
3. PROPOSED BARRIER WALL LOCATION IS BASED ON RESULTS OF SOIL BORING PROGRAM.
4. SOIL BORINGS PERFORMED JANUARY 11, 1996, BY ENVIRONMENTAL AND FOUNDATION DRILLING.
5. SOIL BORING ELEVATIONS AND LOCATIONS SURVEYED ON FEBRUARY 12 AND 16, 1996, BY AREA SURVEY.
6. CONTRACTOR SHALL PROTECT ALL UTILITIES FROM DAMAGE. UNLESS OTHERWISE SPECIFIED CONTRACTOR SHALL REPAIR DAMAGED UTILITIES AT NO ADDITIONAL COST.
7. WHERE CONFLICTS ARE DISCOVERED BETWEEN NEW FACILITIES AND EXISTING UTILITIES, THE LOCATION FOR NEW FACILITIES MAY BE ADJUSTED WITH THE APPROVAL OF MWCI.

Shown location of barrier wall is preliminary. Final alignment of the barrier wall will be determined after design meetings with ACS and physical verification and staking in the field.

REV	DATE	BY	DESCRIPTION	SCALE: 1"=200'	WARNING: 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.	DESIGNED V. AGRAWAL DRAWN P. HUNTER / E. SCOTT CHECKED	SUBMITTED PROJECT ENGINEER R.C.E. NO. DATE MONTGOMERY WATSON CONSULTING ENGINEERS, INC. R.C.E. NO. DATE	MONTGOMERY WATSON Salt Lake City, Utah	APPROVED DATE APPROVED DATE	AMERICAN CHEMICAL SERVICE, INC. GRIFFITH, INDIANA BARRIER WALL EXTRACTION SYSTEM OVERALL SITE PLAN	SHEET C-1 OF SHEETS



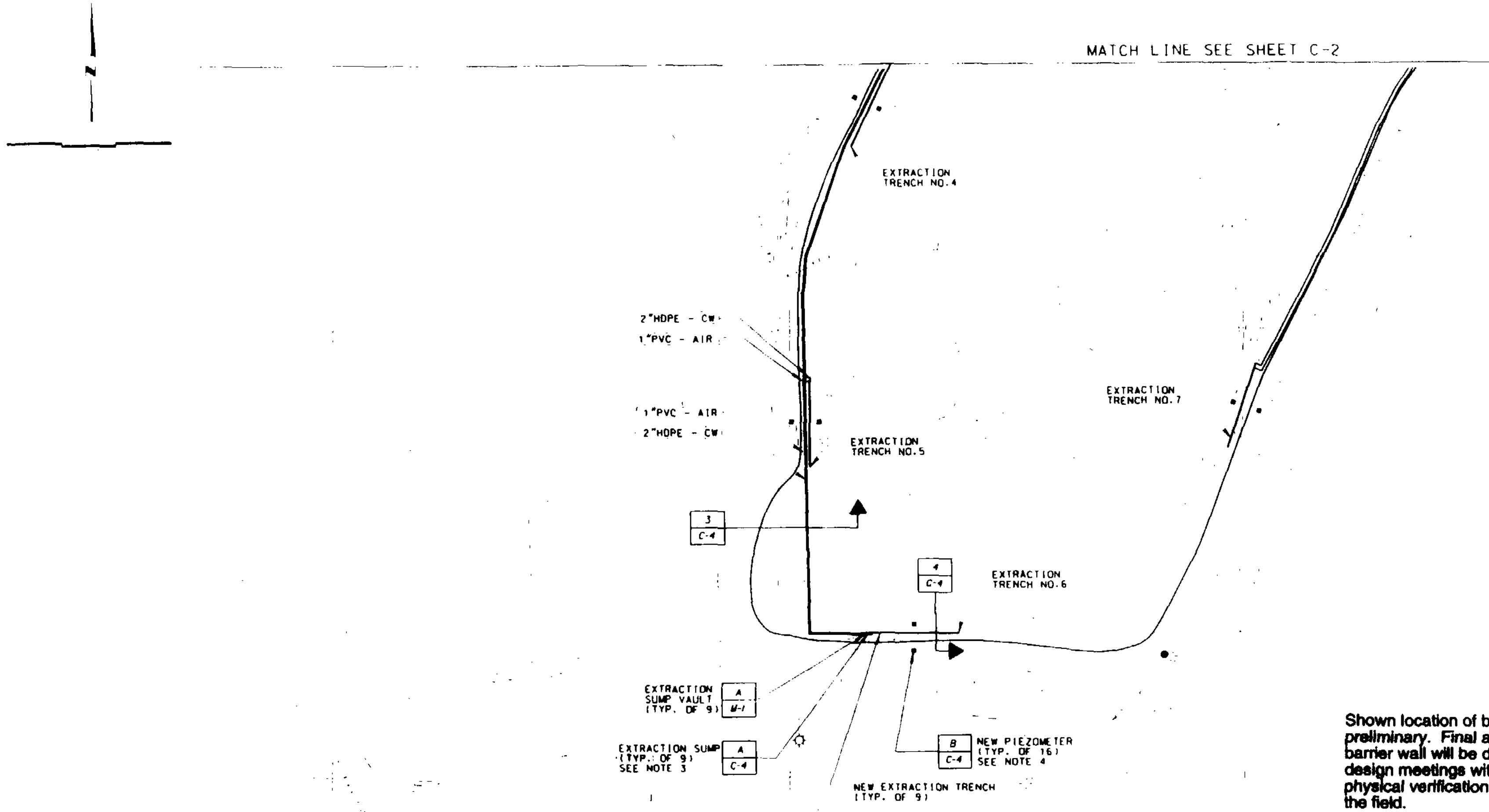
MATCH LINE SEE SHEET C-3

NOTES :

1. PROVIDE CONNECTIONS FOR CONTAMINATED WATER AND COMPRESSED AIR LINES.
2. LOCATION OF TRENCHES AND PIEZOMETERS SUBJECT TO FIELD VERIFICATION
3. CONVEYANCE LINES SHALL BE FIELD ROUTED AND SUBJECT TO BURIED UTILITIES. CONVEYANCE LINES SHALL BE PLACED A MINIMUM OF 4 FEET BELOW GRADE.
4. REFER TO SHEET M 2 FOR EXTRACTION TRENCH SCHEDULE
5. REFER TO SHEET M-2 FOR PIEZOMETER SCHEDULE
6. COORDINATES GIVEN FOR PIEZOMETERS ARE CENTER OF BOREHOLE

Shown location of barrier wall is preliminary. Final alignment of the barrier wall will be determined after design meetings with ACS and physical verification and staking in the field.

SCALE: 1" = 60'-0"	WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE	DESIGNED V. AGRAWAL DRAWN P. HUNTER / E. SCOT CHECKED	SUBMITTED PROJECT ENGINEER R. C. E. NO. DATE MONTGOMERY WATSON CONSULTING ENGINEERS, INC. R. C. E. NO. DATE	MONTGOMERY WATSON Salt Lake City, Utah	APPROVED DATE APPROVED DATE	AMERICAN CHEMICAL SERVICE, INC. GRIFFITH, INDIANA BARRIER WALL EXTRACTION SYSTEM EXTRACTION SYSTEM LAYOUT I	C 2



Shown location of barrier wall is preliminary. Final alignment of the barrier wall will be determined after design meetings with ACS and physical verification and staking in the field.

NOTES :

1. LOCATION OF TRENCHES AND PIEZOMETERS SUBJECT TO FIELD VERIFICATION
2. CONVEYANCE LINES SHALL BE FIELD ROUTED AND SUBJECT TO BURIED UTILITIES. CONVEYANCE LINES SHALL BE PLACED A MINIMUM OF 4 FEET BELOW GRADE.
3. REFER TO SHEET M-2 FOR EXTRACTION TRENCH SCHEDULE
4. REFER TO SHEET M-2 FOR PIEZOMETER SCHEDULE
5. COORDINATES GIVEN FOR PIEZOMETERS ARE CENTER OF BOREHOLE

REV DATE BY DESCRIPTION	SCALE: 1" = 60'-0"	WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.	DESIGNED V. AGRAWAL DRAWN P. HUNTER / E. SCOT CHECKED	SUBMITTED PROJECT ENGINEER R.C.E. NO. DATE MONTGOMERY WATSON CONSULTING ENGINEERS, INC. R.C.E. NO. DATE	MONTGOMERY WATSON Salt Lake City, Utah	APPROVED DATE APPROVED DATE	AMERICAN CHEMICAL SERVICE, INC. GRIFFITH, INDIANA BARRIER WALL EXTRACTION SYSTEM EXTRACTION SYSTEM LAYOUT 2	SHEET C-

APPENDIX C

EXTRACTION SYSTEM CALCULATIONS

MEMORANDUM

MONTGOMERY WATSON

2100 Corporate Drive
Addison, IL
Tel: (708) 691-5020
Fax: (708) 691-5133

From: Peter Vagt

Subject: Evaluation of Extraction Trench and Rate
De-Watering Areas inside Barrier Wall
ACS NPL RD/RA

A Barrier Wall will be constructed surrounding the key waste areas at the ACS Site during the second half of 1996. The Barrier Wall System will include a dewatering system to 1) maintain an inward gradient on the short term and 2), de-watering the interior for the final remediation, scheduled to begin sometime after 1998.

Volume of Groundwater
The 4,000-foot barrier wall will enclose an area of the upper aquifer approximately 730,000 square feet. The base of the upper aquifer is located at the approximate elevation of 620 feet above mean sea level (amsl). The water table within the area to be surrounded by the barrier wall ranges from 632 to 635 feet amsl. Therefore, the saturated thickness of the upper aquifer is between 12 and 15 feet. Assuming a saturated thickness of 15 feet and an aquifer porosity of 30%, it can be calculated that the barrier wall will enclose approximately 3.3 million cubic feet of groundwater.

Recharge to Groundwater
Under the current hydrologic regime, the area to be surrounded by the barrier wall represents the highest water table elevations. Therefore, the zone is not recharged horizontally by groundwater flow from upgradient areas. Recharge for the area to be contained by the barrier wall is only by vertical recharge from infiltration of surface water. The ACS facility currently manages surface water by diverting it to several on-site impoundments including the firepond, and also discharging the surface water to the wetlands north of the site under a current NPDES permit.

The fire pond will be closed during the preliminary site preparations for the barrier wall construction, and water that is currently routed there, will instead be added to the storm water flow that is diverted north under the NPDES permit. It is expected that this change will reduce the total amount of surface water that recharges the groundwater. However, after the barrier wall is completed, recharge will continue to occur by surface water infiltration inside the contained area. Therefore, continuous de-watering will be necessary to maintain inward gradients across the barrier wall. It is estimated that between 10 and 25 percent of the annual precipitation will infiltrate through the surface and recharge the upper aquifer. The average annual precipitation for this area is reported to be 37 inches per year. Therefore, it is calculated that between 4 and 10 inches of precipitation will recharge the upper aquifer each year, across the area contained by the barrier wall. It can further be calculated that this recharge, across the 730,000 square foot area to be contained by the barrier wall is 61,000 cubic feet per inch of infiltration. This represents between 244,000 and 610,000 cubic feet of recharge per year. Further, these recharge rates can be translated into gallons per minute. 244,000 cubic feet per year is equivalent to 3.5 gpm. 610,000 is equivalent to 8.7 gpm.

Horizontal Recharge. Although recharge does not occur horizontally through the upper aquifer under the current hydrologic regime, horizontal recharge will be induced when dewatering commences. During the first phase of de-watering the water level inside the barrier wall will be maintained approximately two feet below the average static water level outside the wall. During the second phase when the area inside the barrier wall is completely de-watered, the total head drop across the wall will be approximately 15 feet. The barrier wall is being designed to have a permeability of $1x10^{-7}$ cm/sec or less, and the total length of the barrier wall is approximately 4,000 feet. The calculation of total flow through the barrier wall (attached) shows that leakage during Phase I will be approximately 0.1 gpm, and the leakage through the wall during complete de-watering will less than 1.0 gpm (calculation attached). These amounts are less than the uncertainty in calculating the vertical recharge. Therefore, they are not included in the calculation of de-watering pumping rates.

De-Watering System Design

An inward gradient will be established and maintained by extracting slightly more water than recharges to the area inside the barrier wall. Extraction rates have been calculated for both Phase I and Phase II de-watering, for a range of precipitation infiltration amounts from 4 inches per year to 24 inches per year. These are summarize in Table 2.

Phase I Extraction. Assuming that approximately 25 percent of the annual precipitation of 37 inches infiltrates each year, it will require a composite pumping rate of approximately 10 gpm to establish and maintain an inward gradient across the barrier wall.

Phase II Extraction. Assuming that approximately 25 percent of the annual precipitation of 37 inches infiltrates each year, it will require a composite pumping rate of approximately 19 gpm to de-water the area inside the barrier wall in a five year period.

The pumping test conducted at the site in March 1995, and slug tests conducted at monitoring wells during the RI, indicate that the hydraulic conductivity of the upper aquifer is on the order of $4x10^{-3}$ cm/sec. Single point extraction wells will not be effective in de-watering the upper aquifer, given this hydraulic conductivity value and the fact that the total saturated thickness of the upper aquifer is less than 15 feet. While a series of single point extraction wells could be used to lower the water table one or two feet and establish an inward gradient, they would not be capable of de-watering the entire upper aquifer. A series of 100-foot long trenches will be necessary to effectively de-water the upper aquifer during Phase II.

Capture Zone Evaluation

Simple numerical modeling was used to predict capture zones for extraction trenches within the barrier wall. *Visual Modflow®* was the software interface used to represent a 4000 foot barrier wall, and nine 100-foot extraction trenches. The model was set up using the aquifer characteristics and properties derived from the investigations previously conducted at the site and used in previous modeling exercises.

Figure 1 shows the finite difference grid used for the modeling. Figure 2 shows the representations of the barrier wall and nine extraction trenches. Figure 3 shows the modeled baseline water table map, representing water levels prior to installation of the barrier wall and extraction trenches. Figure 4 shows the modeled water table map after the barrier wall has been installed, the fire pond has been closed, and groundwater extraction has been conducted for three years from the nine proposed extraction trenches.

Enclosures:

Calculation of De-Watering Extraction Rate
Table 1. Seepage Rate Calculation
Table 2. Summary of Pumping Rates for De-Watering
Backup Calculation for 10 inches per year Infiltration
Figure 1. Finite Difference Grid for Model
Figure 2. Model Representation of Barrier Wall and Extraction Trenches
Figure 3. Baseline Model Run
Figure 4. Modeled Water Table after Barrier Wall and Internal Groundwater Extraction

PJV
C:\MSOFFICE\WINWORD\JOBS\ACS\EXT-Rate.DOC
4077.0080

MONTGOMERY WATSON

BY PJV DATE 6/14/96 CLIENT ACS RD/RA SHEET ____ OF ____
CHKD. BY ______ DESCRIPTION ______ JOB NO. 4077.0080

Calculation of De-Watering Extraction Rate

Known

Area = 730,000 sq. ft.

Upper Aquifer Porosity = 30%

① Volume Represented by 1 inch infiltration

$$730{,}000 \text{ sq ft} \times \frac{1 \text{ ft}}{12 \text{ in}} = 61{,}000 \text{ cu ft}$$

② Pumping Rate Represented by 1 inch of infiltration

$$61{,}000 \frac{\text{cu ft}}{\text{yr}} = \frac{7.481 \text{ gal}}{\text{cu ft}} \cdot \frac{1 \text{ yr}}{365.25 \text{ days}} \cdot \frac{1 \text{ day}}{24 \text{ hours}} \cdot \frac{1 \text{ hour}}{60 \text{ min}}$$

$$= 0.87 \text{ gpm}$$

3. Pumping Rate Represent by Infiltration Percentage of Total Annual Precipitation

Inches/year	GPM
4	3.5
6	5.2
8	6.9
10	8.7
12	10.5
16	13.8
20	17.3

EN. 1S (10/78)

Table 1. Seepage Rate Calculation

ACS NPL Site RD/RA

<u>Calculation of Leakage Through Barrier Wall</u>

During Total De-watering

(Q=KiA)

Hydraulic Conductivity(K) =	1.0E-7 cm/sec	1.2E-5 ft/hr
Thickness of Wall (m) =		1.5 ft
Head Drop Across Wall =		15.0 ft
Height of Barrier Wall =		15 ft
Length of Barrier Wall =		4,000 ft
Gradient Across Wall (i) =		10.0
Flow through 1 square foot of wall =		1.2E-4 cu ft/hr
Flow through entire wall =		7.1 cu ft/hr
Flow through entire wall =		**0.88 gpm**

<u>Calculation of Leakage Through Barrier Wall</u>

While maintaining an inward gradient with 2 foot head drop

(Q=KiA)

Hydraulic Conductivity(K) =	1.0E-7 cm/sec	1.2E-5 ft/hr
Thickness of Wall (m) =		1.5 ft
Head Drop Across Wall =		2.0 ft
Height of Barrier Wall =		15 ft
Length of Barrier Wall =		4,000 ft
Gradient Across Wall (i) =		1.3
Flow through 1 square foot of wall =		1.6E-5 cu ft/hr
Flow through entire wall =		0.9 cu ft/hr
Flow through entire wall =		**0.118 gpm**

Table 2. Summary of Pumping Rates for Dewatering

Annual Infiltration	Phase 1	Phase II. Dewatering Pumping Rates	
	Inward Gradient	**In 3 Years**	**In 5 Years**
4 in/year	3.5 gpm	19.5 gpm	13.5 gpm
6 in/year	5.2 gpm	21.4 gpm	15.4 gpm
8 in/year	7.0 gpm	23.2 gpm	17.2 gpm
10 in/year	8.7 gpm	25.0 gpm	19.0 gpm
12 in/year	10.4 gpm	26.6 gpm	20.6 gpm
16 in/year	13.9 gpm	30.1 gpm	24.1 gpm
20 in/year	17.3 gpm	33.5 gpm	27.0 gpm
24 in/year	20.8 gpm	37.0 gpm	31.0 gpm

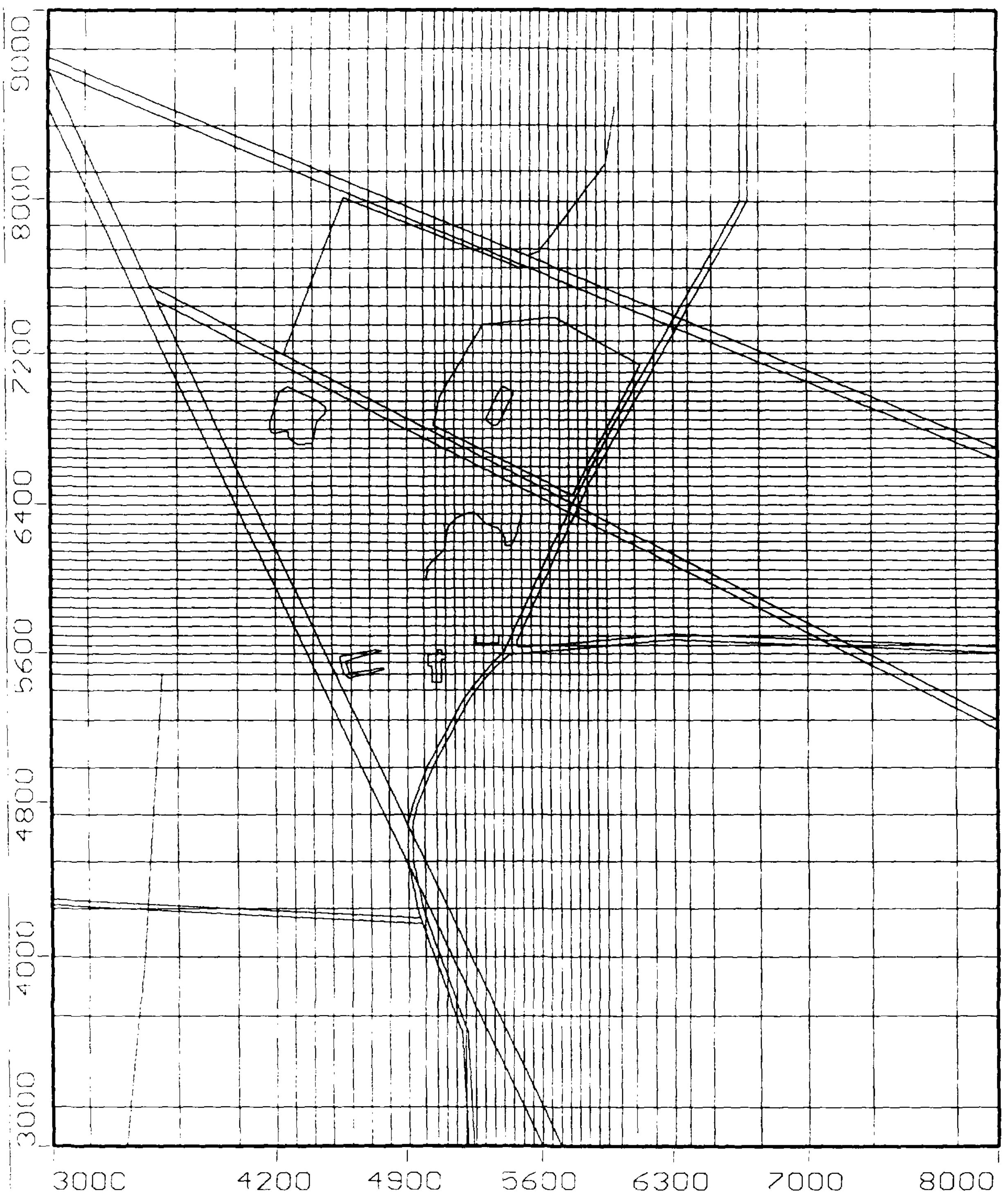
De-Watering in 3 Years

			De-Watering Rate:	25.0 gpm
			De-watering Volume:	146,775 cf/month
		Precipitation:	10 in/year	
		Input:	50,694 cf/month	
	Area:	730,000 sq ft		
	Volume:	3,285,000 cf H20		
Yr	Month	Remaining Volume	Infiltration (Input)	Extraction (Removed)
1	1	3,285,000	50,694	-146,775
	2	3,188,919	50,694	-146,775
	3	3,092,839	50,694	-146,775
	4	2,996,758	50,694	-146,775
	5	2,900,678	50,694	-146,775
	6	2,804,597	50,694	-146,775
	7	2,708,517	50,694	-146,775
	8	2,612,436	50,694	-146,775
	9	2,516,356	50,694	-146,775
	10	2,420,275	50,694	-146,775
	11	2,324,194	50,694	-146,775
	12	2,228,114	50,694	-146,775
2	13	2,132,033	50,694	-146,775
	14	2,035,953	50,694	-146,775
	15	1,939,872	50,694	-146,775
	16	1,843,792	50,694	-146,775
	17	1,747,711	50,694	-146,775
	18	1,651,631	50,694	-146,775
	19	1,555,550	50,694	-146,775
	20	1,459,469	50,694	-146,775
	21	1,363,389	50,694	-146,775
	22	1,267,308	50,694	-146,775
	23	1,171,228	50,694	-146,775
	24	1,075,147	50,694	-146,775
3	25	979,067	50,694	-146,775
	26	882,986	50,694	-146,775
	27	786,906	50,694	-146,775
	28	690,825	50,694	-146,775
	29	594,744	50,694	-146,775
	30	498,664	50,694	-146,775
	31	402,583	50,694	-146,775
	32	306,503	50,694	-146,775
	33	210,422	50,694	-146,775
	34	114,342	50,694	-146,775
	35	18,261	50,694	-146,775
	36	-77,819	50,694	-146,775

De-Watering in 5 Years

			De-Watering Rate:	19.0 gpm
			Volume to Dewater:	334,647 cf/quarter
		Precipitation:	10 in/year	
		Input:	152,083 cf/quarter	
Area:		730,000 sq ft		
Volume:		3,285,000 cf H20		
Yr	Quarter	Remaining Volume	Infiltration (Input)	Extraction (Removed)
1	1	3,285,000	152,083	-334,647
	2	3,102,436	152,083	-334,647
	3	2,919,873	152,083	-334,647
	4	2,737,309	152,083	-334,647
2	5	2,554,745	152,083	-334,647
	6	2,372,182	152,083	-334,647
	7	2,189,618	152,083	-334,647
	8	2,007,054	152,083	-334,647
3	9	1,824,491	152,083	-334,647
	10	1,641,927	152,083	-334,647
	11	1,459,363	152,083	-334,647
	12	1,276,800	152,083	-334,647
4	13	1,094,236	152,083	-334,647
	14	911,672	152,083	-334,647
	15	729,109	152,083	-334,647
	16	546,545	152,083	-334,647
5	17	363,981	152,083	-334,647
	18	181,418	152,083	-334,647
	19	-1,146	152,083	-334,647
	20	-183,710	152,083	-334,647

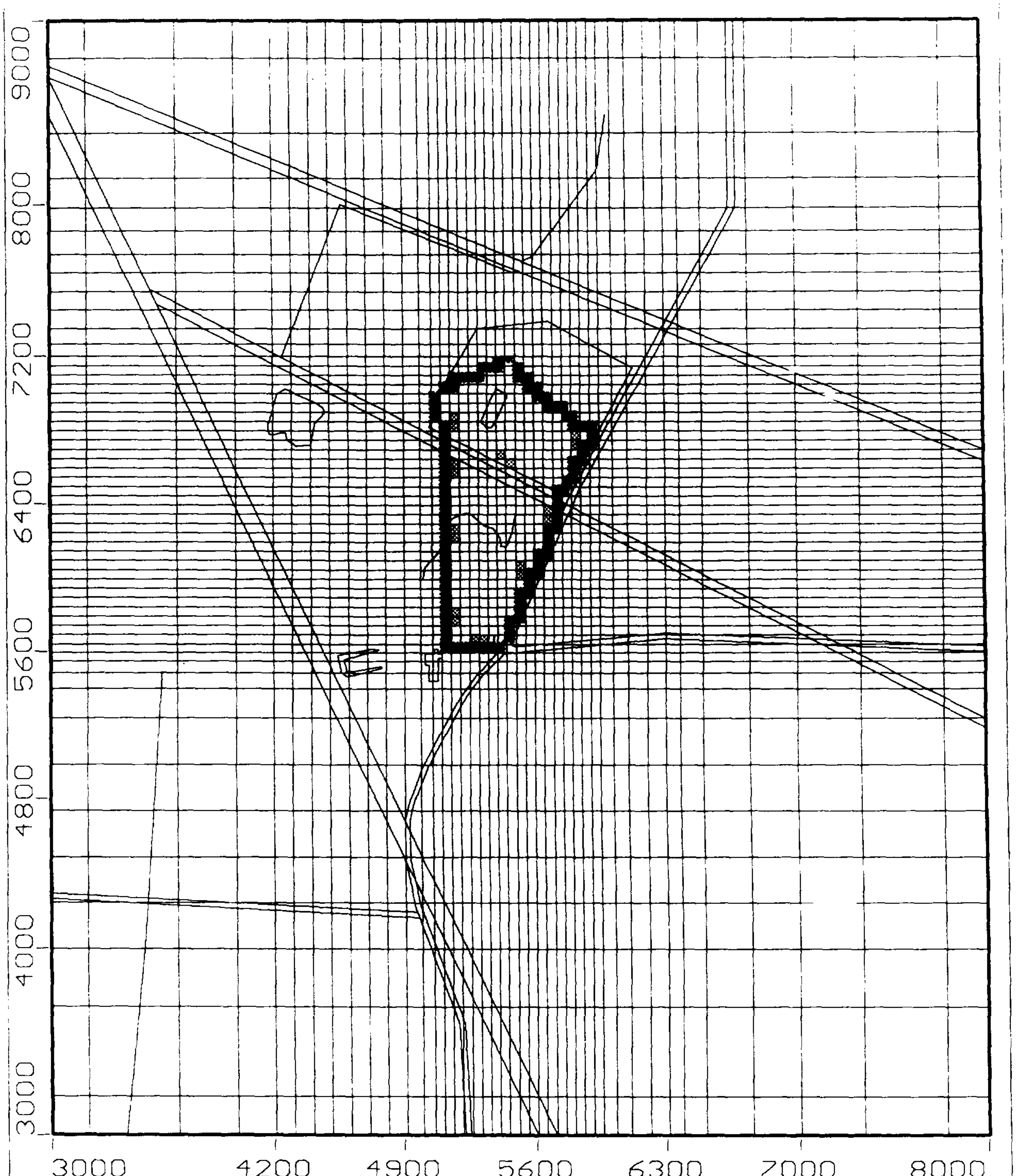
Figure 1. Finite Difference Grid for Model



Montgomery Watson – Wayne, PA
Project: ACS–Rem7
Description: B Wall & 9 Ext Trenches
Modeller: PJV
3 Jun 96

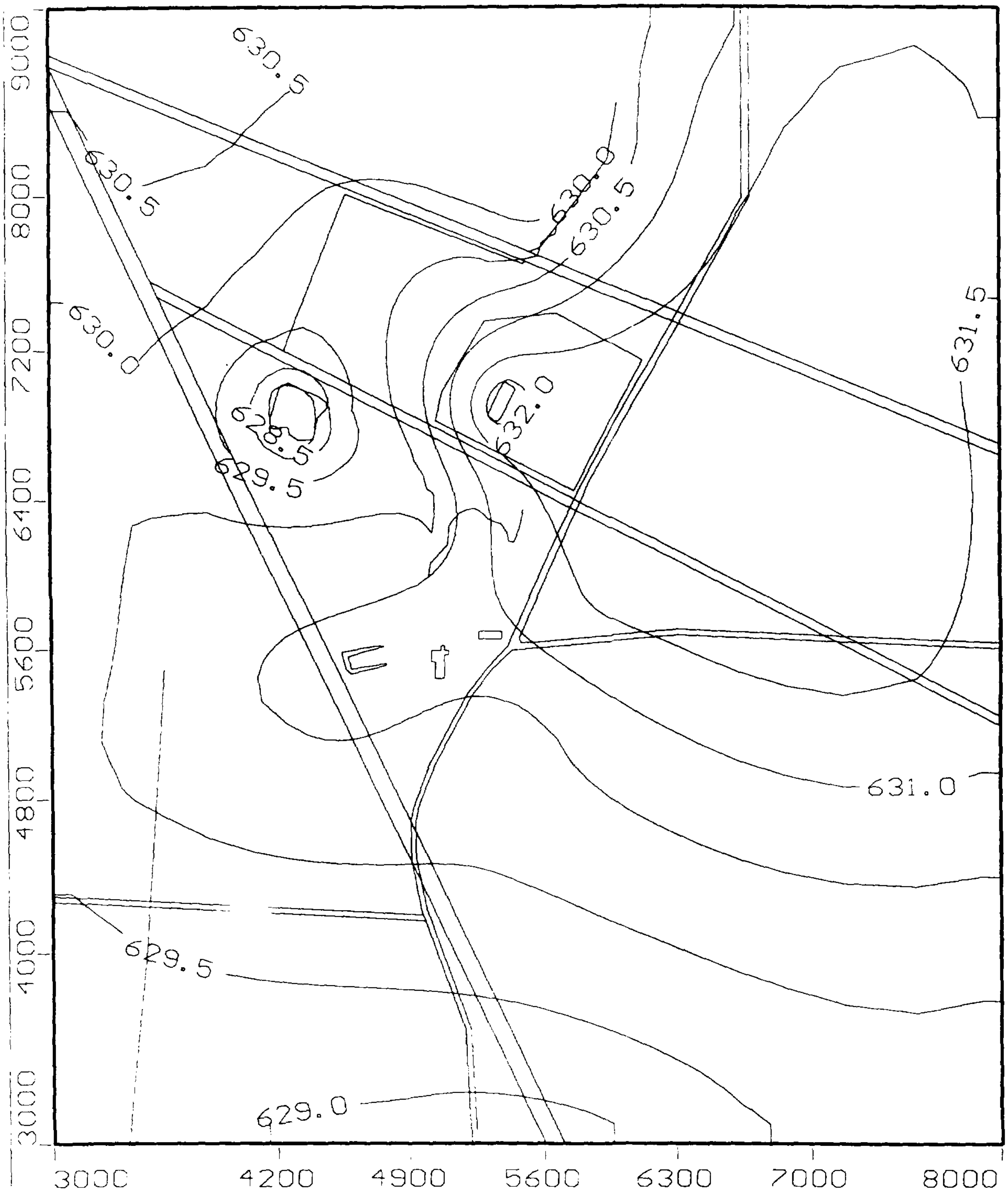
Visual MODFLOW v.1.50, (c) 1995
Waterloo Hydrogeologic Software
NC: 42 NR: 56 NL: 1
Current Layer: 1

Figure 2. Model Representation of Barrier Wall and Extraction Trenches



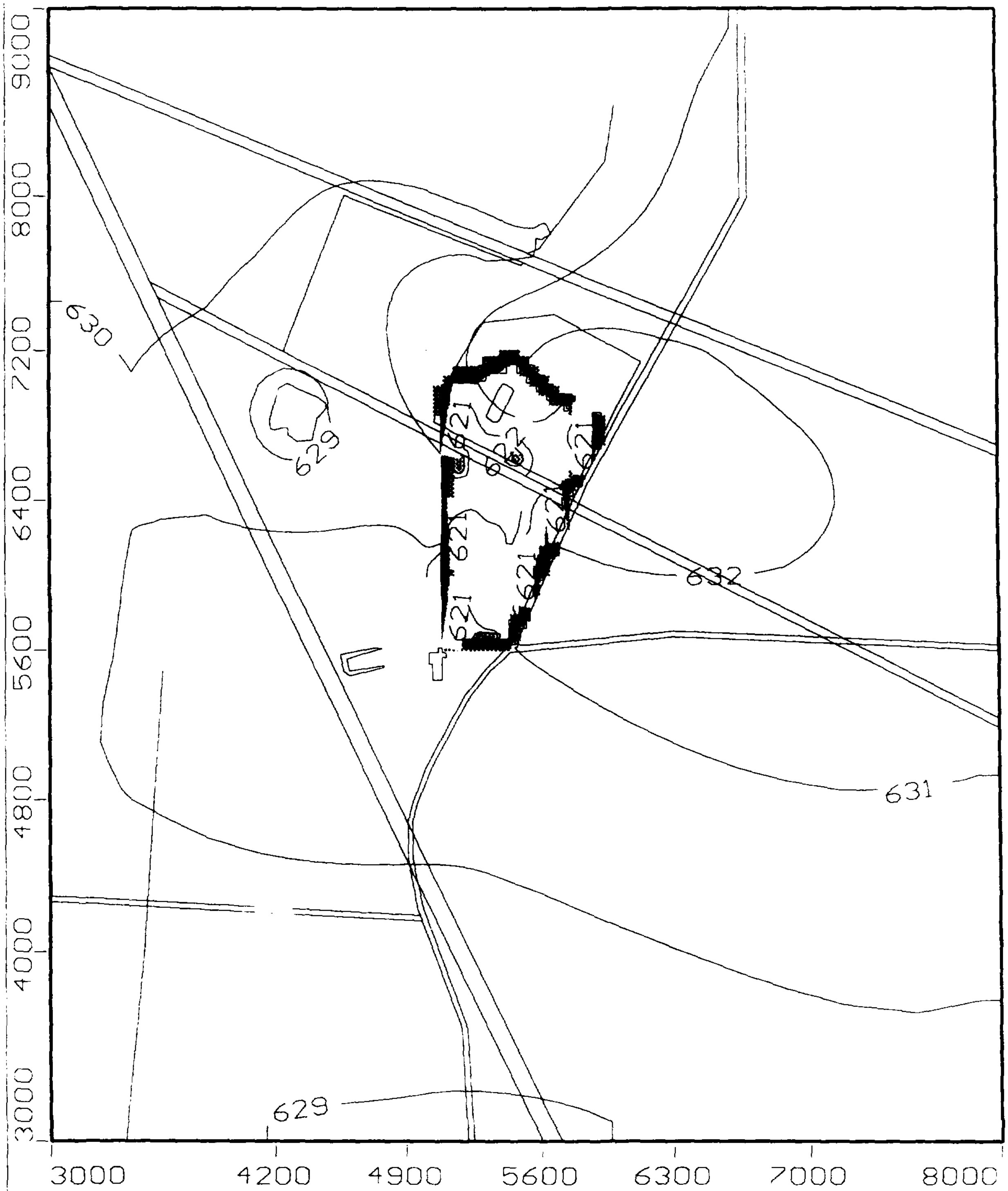
Montgomery Watson – Wayne, PA Project: ACS–Rem8 Description: Bar Wall & 9 Trenches Modeller: PJV 3 Jun 96	Visual MODFLOW v.1.50, (c) 1995 Waterloo Hydrogeologic Software NC: 42 NR: 56 NL: 1 Current Layer: 1

Figure 3. Baseline Model Run



Montgomery Watson – Wayne, PA	Visual MODFLOW v.1.50, (c) 1995
Project: ACS–Rem3	Waterloo Hydrogeologic Software
Description: Baseline Water table	NC: 42 NR: 56 NL: 1
Modeller: PJV	Current Layer: 1
3 Jun 96	

Figure 4. Modeled Watertable after Barrier Wall and Groundwater Extraction



Montgomery Watson - Wayne, PA
Project: ACS-Rem8
Description: Bar Wall & 9 Trenches
Modeller: PJV
3 Jun 96

Visual MODFLOW v.1.50, (c) 1995
Waterloo Hydrogeologic Software
NC: 42 NR: 56 NL: 1
Current Layer: 1

APPENDIX D

TEST CELL
TECHNICAL SPECIFICATION AND DRAWINGS

APPENDIX D

TEST CELL TECHNICAL SPECIFICATION AND DRAWINGS

Appendix D presents a portion of the sheet pile Request for Bid (RFB) that was used to solicit bids from construction subcontractors. Included in this appendix is the sheet pile description, method of installation, method of sealing, pile driving/grouting equipment, definition of refusal, and a drawing for the sheet pile layout.

Since the sheet pile RFB was issued, a decision has been made to exclude installation of the off-site test cell. The off-site test cell shown on Figure 6 herein will not be included in the treatability studies. Figure 6 will be modified to reflect the new layout for the test cell and submitted with the 100 Percent Design Submittal.

SECTION 02390
SHEET PILES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work includes selecting the appropriate steel sheet pile configuration (weight per foot and dimensions), and supplying and installing the steel sheet piles in the two test areas as shown on the drawings.

1.02 UNIT PRICE - MEASURE AND PAYMENT

A. Basis of Measurement: Sheet piles - square foot driven as measured below ground surface. Contractor shall be paid for sheet pile that meet refusal above the desired finished depth, and for redriving the sheet pile in a new alignment. Contractor shall also be paid for removing sheet piles that meet early refusal.

B. Basis of Payment: Includes selecting, and supplying, sheet piles and related materials; and installing sheet piles per these specifications.

1.03 REFERENCE STANDARDS

A. ASTM A328 Specification for Steel Sheet Piling

B. ASTM A690 Specification for High-Strength Low-Alloy Steel H-Piles and Sheet Piling for Use in Marine Environments

1.04 SUBMITTALS

A. Submit the following to MWCI for review and approval:

1. Detailed construction schedule including start and completion dates and milestones, one week in advance of construction start date.
2. The proposed method to install the sheet piles, including details of the sheet pile type, material, and driving and redriving methods; sealing and waterproofing materials and method; and definition of "refusal" with the bid.
3. Shop drawings for steel piles one week in advance of construction start date.

PART 2 PRODUCTS

2.01 STEEL SHEET PILES

A. Steel sheet piles shall be rolled steel sections of the weight, and shape to withstand the driving force necessary to install through the soil and debris, and length to extend to the clay confining layer. Steel sheet piles shall meet the requirements of either ASTM A328 or A690.

B. Contractor shall select the weight, shape, and length of the sheet piles and include the information in his bid.

C. Splices in steel piles shall be made by a full penetration butt weld of the entire cross section. Splices in the top 10 feet of the piles shall not be permitted. All welding shall be performed by qualified welding operators.

D. Joints between steel pile shall be sealed and water tight to prevent groundwater migration through the sheet piles. Seals may be either grouted or some other method, which has been pre-approved by MWCI.

PART 3 EXECUTION

3.01 DRIVING SHEET PILES

A. Steel sheet piles shall be driven with hammers adequate to drive the pile to the required depths in satisfactory condition.

B. To maintain satisfactory alignment, sheet piles shall be driven in increments of penetration necessary to prevent distortion, twisting out of position, or pulling apart at interlocks. To facilitate closure, it may be advantageous to set up piles for a complete length of wall before initial driving; piles thus setup can be progressively driven in short increments of penetration.

C. Protect pile head during driving, using cushion cap with full bearing on pile butt for even distribution of hammer blow.

D. Deliver hammer blows to central axis of pile.

E. Do not damage piles during driving operations.

F. Re-drive piles which have lifted due to driving adjacent piles, or by soil uplift.

G. Seal and waterproof joints between adjacent piles.

H. Cut off tops of piles even with the surrounding land grade.

I. Drive piles to a depth of 2 ft into the clay confining layer as shown on the test cell boring logs (approximately 25 to 30 ft below grade).

3.02 PILE REFUSAL

A. Contractor shall propose a definition for "refusal" in his bid. Contractor shall pull piles that meet refusal before reaching the specified depth. Piles shall be re-driven, in a modified alignment if necessary after receiving MWCI's approval, to complete each test cell.

3.03 TOLERANCES

A. Maximum variation from vertical for plumb piles: 1 in 48.

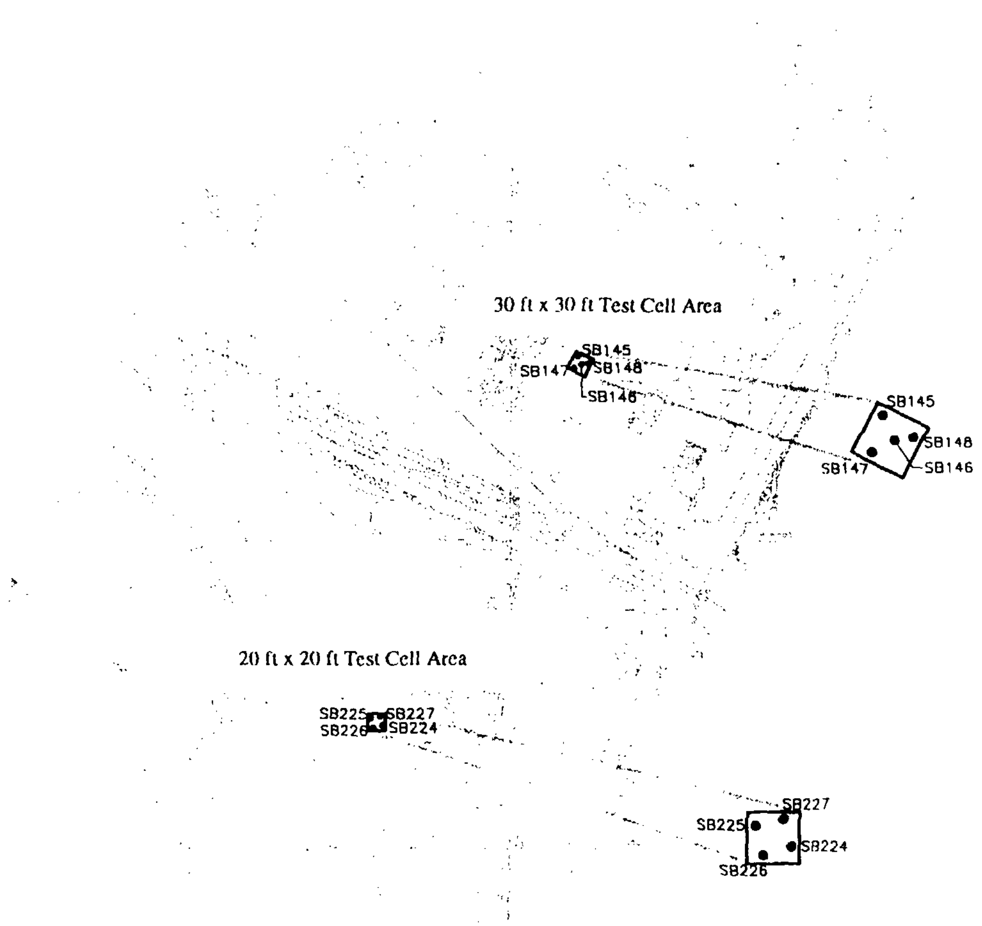
3.04 CUTOFFS

A. Tops of sheet piling shall be cut off or driven down to a straight line even with the surrounding land grade. If a cutting torch is used on steel sheet piling, the cut surface shall be made as smooth as practicable by grinding or other approved methods.

B. If heads of sheet piles are appreciably distorted or otherwise damaged below cut-off level, damaged portions shall be removed and replaced, or repaired to the satisfaction of MWCI.

END OF SECTION

J:\4077\T_LEWIS\SUB\BARRER\35186CS1.DOC



LEGEND

- PILOT TEST CELL
- SB224 — PILOT TEST CELL SOIL BORING LOCATION AND NUMBER
- RAILROAD TRACK
- TOPOGRAPHIC CONTOUR

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. VERTICAL DATUM IS U.S.G.S. DATUM. CONTOUR INTERVAL IS 2 FEET.
3. SOIL BORINGS PERFORMED JANUARY 17, 1996 THROUGH FEBRUARY 12, 1996, BY ENVIRONMENTAL AND FOUNDATION DRILLING.
4. SOIL BORING ELEVATIONS AND LOCATIONS SURVEYED ON FEBRUARY 12 AND 16, 1996, BY AREA SURVEY.

north

0 200 400

SCALE IN FEET

FIGURE 6

Drawn By DLF,LCL
Date 3/29/96
Developed By PJV
Approved By PJV
Reference
Revisions

PILOT TEST CELL SOIL BORING LOCATION MAP

BARRIER WALL ALIGNMENT INVESTIGATION
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number 4077.0075 B4

MONTGOMERY WATSON

APPENDIX E

STANDARD OPERATING PROCEDURES FOR CONSTRUCTION-RELATED HEALTH AND SAFETY

[To Be Included In The 100 Percent Design Submittal]

APPENDIX F

QUALITY ASSURANCE PROJECT PLAN
PERFORMANCE MONITORING OF THE BARRIER WALL AND ASSOCIATED GROUNDWATER EXTRACTION SYSTEM

[To Be Included In The 100 Percent Design Submittal]

ATTACHMENT A

HEALTH AND SAFETY PLAN
PERFORMANCE MONITORING OF THE BARRIER WALL AND ASSOCIATED GROUNDWATER EXTRACTION SYSTEM

[To Be Included In The 100 Percent Design Submittal]